DOCUMENT RESUME

ED 162 490 EC 112 763

AUTHOR Wynn, Margaret; Wynn Arthur
TITLE The Prevention of Preterm Birth: An Introduction to Some European Developments Aimed at the Prevention of Handicap.
INSTITUTION Foundation for Education and Research in Child-Bearing, London (England).
PUB DATE 77
NOTE 55p.
AVAILABLE FROM Foundation for Education and Research in Child-Bearing, 27 Walpole Street, London SW3 England (3 British pounds)

EDRS PRICE MF-$0.83 HC-$3.50 Plus Postage.
DESCRIPTORS Death; *Foreign Countries; Handicapped Children; *Incidence; Infant Mortality; Infants; Medical Services; Medical Treatment; Pregnancy; *Premature Infants; *Prenatal Influences; *Prevention

ABSTRACT

The report presents information on the incidence and prevention of preterm births which are related to infant death and subsequent handicapping conditions. The first chapter analyzes statistics from Sweden, Britain, Scotland, Canada and the U.S. on optimum birthweight. European developments in the prevention of preterm birth are reviewed as well as limitations of the usefulness of preventing preterm birth. The importance of adequate antenatal care prevention services is stressed, and suggestions are made for improving care. Social, behavioral, and biological factors associated with preterm birth are described. (CI)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

ED162490

The Prevention of Preterm Birth

An introduction to some European developments aimed at the prevention of handicap

by

Margaret Wynn

and

Arthur Wynn

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Margaret & Arthur Wynn

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

EC112763

Foundation for Education and Research in Child-Bearing

LONDON 1977

PRICE £3.00

CONTENTS

ACKNOWLEDGEMENTS ii

PREFACE : THE HOPE OF PREVENTING PRETERM BIRTH 1

CHAPTER ONE: THE BEST BIRTHWEIGHT

Weights of Babies at Birth in Sweden, Britain, Scotland, Canada and U.S.A. 3
Birthweight and Survival in the First Year of Life 5
Low Birthweight and Subsequent Handicap 7
Birthweight Distributions as Indicators of Medical and Social Needs 7

CHAPTER TWO: EUROPEAN DEVELOPMENTS IN THE PREVENTION OF PRETERM BIRTH

Claims for New Drugs 10
Association of Preterm Birth and Mortality 11
Association of Postmaturity and Mortality 13
British Trends in Postmaturity and Preterm Birth 14
The Evaluation of New Techniques 15
Some Questions to be Answered about Delaying Drugs 17
Reducing Perinatal Casualties among Twins 18
Reducing Perinatal Casualties from Breech Delivery 20
Infection Control must Accompany Use of Delaying Drugs 21

CHAPTER THREE: SOME LIMITATIONS OF THE USEFULNESS OF PREVENTING PRETERM BIRTH

Too Small and Preterm 22
Preventing Preterm Birth will not Benefit All Babies 25

CHAPTER FOUR: RESPONSIBILITY OF ANTENATAL CARE SERVICES FOR PREVENTING PRETERM BIRTH

An Inadequate Concept of Antenatal Care 27
A Cervical Examination at Sixteen Weeks 27
Day and Night Emergency Service Essential 28
Responsibility of Antenatal Care for Infection Control 29
Antenatal Records Essential for Prevention 29

CHAPTER FIVE: ANTECEDENTS OF PRETERM BIRTH

Social, Behavioural and Biological Factors 31
Obstetric and Gynaecological Care of Women and Girls 31
Prevention of Preterm Birth Following Trauma from Induced Abortion 34
Prevention of Reproductive Failure Associated with Infection Following an Induced Abortion 36
Fatigue as a Cause of Preterm Birth 36

CHAPTER SIX: THE CASE FOR AN INQUIRY INTO ANTENATAL CARE AND MATTERS FOR THE AGENDA 39

NOTES 44

REFERENCES 47

Note on the Foundation

The Foundation for Education and Research in Child-Bearing was established in March 1971 as a charitable trust. The Foundation aims to disseminate basic information on all aspects of child-bearing and to encourage and assist research.

For further particulars apply to the Secretary, Foundation for Education and Research in Child-bearing, 27 Walpole Street, London SW3. Telephone 01-235 1343.

This publication was submitted in evidence to the Royal Commission on the National Health Service by the authors. It is part of a series by Margaret and Arthur Wynn on the prevention of handicap of congenital, perinatal and early childhood origin:

Wynn, M. (1972) 'Services for the family' *Irish Journal of Sociology* 2/6 613-635

Wynn, M. & Wynn, A. (1974) *The Protection of Maternity and Infancy: A study of the services for pregnant women and young children in Finland* Council for Children's Welfare

Wynn, M. & Wynn, A. (1974) *The Right of Every Child to Health Care: A study of the protection of the young child in France* Council for Children's Welfare

Wynn, M. & Wynn, A. (1975) *Nutrition Counselling in the Prevention of Low Birth-Weight: Some conclusions about antenatal care following a visit to Canada* Foundation for Education and Research in Child-Bearing

Wynn, M. & Wynn, A. (1976) 'Nutrition and low birth-weight' *Action Magazine* National Fund for Research into Crippling Diseases April 1976. 16-20

Wynn, A. (1976) 'Health Care Systems for Pre-School Children' *Proceedings of the Royal Society of Medicine* 69/5 340-343

Wynn, M. & Wynn, A. (1976) *Prevention of Handicap of Perinatal Origin: An introduction to French policy and legislation* Foundation for Education and Research in Child-Bearing

Also by Margaret Wynn:
Fatherless Families, Michael Joseph 1964
Family Policy, Michael Joseph 1970, Penguin Books 1972

ACKNOWLEDGEMENTS

We acknowledge with gratitude the continued support of the Foundation in our studies of possible means of preventing handicap. Once again we have relied heavily on the help of the medical advisers of the Foundation who read and commented on our first draft. We have endeavoured to meet all their criticisms but we take full responsibility for the final text. We wish to thank them warmly for their guidance.

We are indebted to Dr J.A. Clarke of the Scottish Home & Health Department for his guidance in the use of Scottish health statistics

This study was inspired by a visit to Sweden financed by the National Fund for Research into Crippling Diseases. We are grateful for that support. The full report on our study of material and child health care systems in Sweden will be published elsewhere when we shall have the pleasure of thanking all those who kindly helped us in our study, but we would here like especially to acknowledge the help of Professor Anders Aberg, Department of Obstetrics in the University Hospital of Lund: Dr Bengt Bjerre, Department of Obstetrics and Gynaecology in Malmo and Dr Birgitta Brateby and Dr Lars Brateby of the University Hospital of Uppsala. The data distributions of birthweight and gestation in Sweden were kindly provided by Dr Anders Ericson, Assistant Director at the National Board of Health.

M.W. — A.W.

PREFACE

THE HOPE OF PREVENTING PRETERM BIRTH

The British Court Report 1976 on child health services was moved to say:

> "In contemporary terms infant mortality is a holocaust, equal to all the deaths of the succeeding 24 years of life." (1)

In England and Wales alone in 1976 there were 8,108 deaths of children under one year, and 5,649 stillbirths or deaths in utero after 28 weeks' gestation.

This mortality is like the tip of an iceberg concealing the more numerous babies who are ill. Among the survivors, and particularly among death's near misses, are many babies who retain the scars of this early illness. For every perinatal death there are two or three survivors with more or less severe handicap, and other survivors with lesser degrees of disability. (2) Handicapping conditions resulting from early illness have tragic consequences for families and wide social repercussions which last for 70 to 80 years into the future.

Infant death is primarily a private family tragedy. Handicap is a source of much unhappiness to the handicapped themselves, and to families for long periods. The repercussions of handicap also extend far beyond the individual family and are costly to the community and to governments. Preventive action is highly profitable to governments, to the community and to families.

The Court Report said that in our attempts to understand and reduce perinatal mortality the first factor of central importance was:

> "that in 1974, 76 per cent of first day deaths and 58 per cent of deaths within the first month occurred in low birthweig t babies weighing 2,500g or less." (3)

There were 41,330 live births in 1974 in England and Wales of babies weighing under 2,500g, say 5lbs 8oz.

The prevention of low birthweight was, however, outside the terms of reference of the Court Committee as it is a task for the health services for women, as we shall see, rather than for child health services. "Low birthweight" and "prematurity" used to be synonymous and an American symposium on prematurity began:

> "Prematurity is the greatest single problem facing obstetricians, pediatricians and parents in the United States today. Out of about 4,000,000 babies born in 1964, well over 250,000 were premature." (4)

Prematurity in this quotation meant simply low birthweight. Birth that happens too soon, which may be called "preterm birth", is one of two main factors in the causation of low birthweight. The other main factor is failure to grow or growth retardation. The present study discusses only the prevention of preterm birth. It is shown that most of the babies who die or who are seriously ill are both born preterm and are also to a greater or lesser extent growth-retarded. It was thought necessary to do this in Chapter Three to destroy any illusion that preventing preterm birth solves the whole problem of low birthweight and the associated morbidity and handicap. Preterm birth is only part of a wider problem, but an important part.

The present study was inspired by discussions in Sweden about the Swedish birthweight distribution which shows a lower prevalence of underweight babies than is to be found in all but a very few places in the British Isles. There is less growth-retardation in Sweden and there is also less preterm birth. It was explained that the smaller numbers born preterm were increasingly the direct result of medical intervention to prevent preterm birth which was now possible in most cases. There is a new hope of preventing preterm birth.

Following these discussions in Sweden a study of Swedish papers led very quickly to West and East Germany and neighbouring countries including Austria, France, Hungary and Switzerland. It was found that there were single teaching hospitals, for example the Charité Hospital of the Humboldt University of Berlin, claiming to have stopped more than a 1000 spontaneous abortions and preterm births and to have enabled the pregnancies to continue beyond 38 weeks' gestation. (5) Many such series were found to have been reported, about two-thirds in the German language.

The importance of preventing birth before 38 weeks' gestation may be seen from the Scottish statistics for 1974. In that year in Scotland 11.4 per cent of all births happened before 38 weeks' gestation, or 6,099 births. (6) These preterm births included 65 per cent of the perinatal deaths, or 727 deaths.

How far then could these preterm births and associated deaths have been prevented? If preterm births are prevented are the resulting babies sound and healthy? Have these techniques for preventing preterm birth been adequately evaluated in their effects on mother and child? When is it wise to prevent spontaneous abortions, and if so, after how many weeks' gestation? What is the risk of postmaturity or of postponing delivery for too long?

When searching for the answers to such questions it is found very quickly that there are great divergences in obstetric practice and in the drugs used from one country to another. Any discussion of the prevention of preterm birth must include a discussion of these differences. Obstetric practices in the German speaking world are not uniform but some dominant German attitudes inevitably emerge in the present study. Indications regarded as essential before inducing labour differ radically between Britain and continental Europe. Such divergences of practice point to the need for more obstetric research to evaluate the consequences of procedures to mothers and babies using expert and defensible methodology.

For many years the world's approach to preterm birth and to growth retardation was like that of the natural historian who observes and records and classifies. There have been major birth surveys in most developed countries which have recorded the many factors associated with low birthweight. It was partly this accumulation of epidemiological data that has led some twenty countries to initiate projects aimed at reducing the prevalence of low birthweight. The prevention of preterm birth is therefore an important part of a new and expanding branch of preventive medicine. Much, however, remains to be done to define the right use of the new drugs and surgical techniques now available in Britain. The stage has been reached at the present time when large scale practical trials of new techniques are appropriate rather than universal application without further evaluation.

By 1974 the deaths of women in childbirth in England and Wales had fallen to only 2½ per cent of the mortality less than half a century before. However in 1974 there were 276 deaths of babies before or after birth for every maternal death. The time has come for a national endeavour to reduce these infant deaths and the associated morbidity and handicap. This requires a political commitment as did the reduction in maternal mortality. The necessary progress in the capability of medical technology is not all that is needed. A system and an organisation is required to apply existing knowledge in practice. In particular a new look is needed at antenatal care and this is discussed in Chapter Four.

We begin in Chapter One by considering Swedish birthweight distributions compared with those of Britain, Scotland, Canada and the U.S.A. The lower Swedish perinatal and infant mortalities are mainly attributable to the smaller percentages of Swedish babies in the lower birthweight brackets. Chapter One therefore illustrates the wider problem to which the prevention of preterm birth has to make its contribution. Chapter Two introduces some of the new techniques available for preventing preterm birth and for reducing the numbers of small babies in the higher mortality ranges.

POSTSCRIPT

The Minister of State for Health in the House of Commons on 25th July 1977 announced that the Children's Research Liaison Group had accepted the report of the Working Party on Infant and Perinatal Mortality and Morbidity chaired by Professor J.N. Morris. The present study introduces evidence in support of the following recommendations of this Working Party:

> "1. A clinical trial of the effectiveness of cervical suture in patients with a past history of midtrimester abortions or terminations of pregnancy.
> 3. A randomised, controlled, multicentre trial of the various commonly used and new myometrial depressants.
> 5(a). A study to establish present day patterns of antenatal contact between expectant mothers and the health services.
> 5(b). Action research into ways of improving antenatal contact prior to the 16th week of pregnancy between expectant mothers and the health services".

CHAPTER ONE

THE BEST BIRTHWEIGHT

WEIGHTS OF BABIES AT BIRTH IN SWEDEN, BRITAIN, SCOTLAND, CANADA AND U.S.A.

Most babies who die or are ill are too small at birth. Birth too soon, or preterm birth, is one major cause of smallness. The present chapter introduces the wider subject of smallness, or low birthweight, as background to the narrower problem of preterm birth and so provides part of the answer to the question: Why prevent preterm birth?

Swedish enthusiasm for babies of high birthweight is explained in Table 1.1 and in Figure 1A showing perinatal mortality by birthweight for Sweden in 1973. Table 1.2 then shows Swedish success in persuading babies to join the weight brackets with the lowest mortality. Britain and Scotland are compared in both tables.

Table 1.1

PERINATAL MORTALITY BY BIRTHWEIGHT: SWEDEN, BRITAIN AND SCOTLAND

109,410 Swedish, 57,782 Scottish and 16,792 British live and stillbirths

Birthweight range		Perinatal mortality deaths per 1000 still and live births		
grams	Imperial Weight	Sweden (1) 1973	Britain (2) 1970	Scotland (3) 1974
less than 1499	less than 3lb 4oz	602.6	?	674.6
1500 to 1999	3lb 5oz - 4lb 6oz	211.5	260.9	237.3
2000 to 2499	4lb 7oz - 5lb 8oz	61.6	69.1	64.5
2500 to 2999	5lb 8oz - 6lb 9oz	15.4	18.0	13.4
3000 to 3499	6lb 10oz - 7lb 11oz	5.0	6.7	6.9
3500 to 3999	7lb 12oz - 8lb 13oz *	3.3	4.2	4.6
4000 to 4499	8lb 14oz - 9lb 14oz *	3.1	?	2.8
4500 to 4999	9lb 15oz - 11lb 0oz	4.2	?	5.8

* optimum range for survival

Table 1.2

PERCENTAGE DISTRIBUTIONS OF BIRTHWEIGHTS: SWEDEN, BRITAIN AND SCOTLAND

	Sweden (1) 1973	Britain (2) 1970	Scotland (3) 1974
Under 1500 g	0.8	1.0	1.1
1500 to 1999	0.9	1.2	1.3
2000 to 2499	2.8	4.7	5.3
2500 to 2999	11.9	18.9	18.8
3000 to 3499	33.9	39.1	39.6
3500 to 3999 optimum range	33.6	26.8	26.2
4000 to 4499 for survival	13.1		6.7
4500 to 4999	2.4	8.2	0.9
Over 5000	0.3		0.1
Total	99.7	99.9	100.0

It is seen in Figure 1A and in Table 1.1 that the lowest perinatal mortality among both Swedish and Scottish babies was experienced in the birthweight range from 3500 to 4500 g (7¾ to 10lbs). The Swedish perinatal mortality rate of 3.2 in this range is so low compared with 14.2 for the whole Swedish population and 21.0 for England and Wales in the same year 1973, that it is apparent that not only is this obstetrically the most advantageous birthweight range, but there can be at most a very small minority of Swedish, Scottish or English women for whom it is not suitable.

Most causes of perinatal mortality are also causes of handicap of perinatal origin more particularly among babies who are severely ill and nearly die, or death's near-misses. It has been estimated that for every perinatal death two to three children are handicapped as a result of damage to the central nervous system. The optimum birthweight ranges produce not only the smallest incidence of death but the smallest percentages of handicapped children.

Sweden has had the lowest perinatal mortality of any country in the world since 1964. Tables 1.1 and 1.2 cover 99.9 per cent of all babies born in 1973 in Sweden and include about 7 per cent of babies born to foreign born immigrant mothers. The difference between the perinatal mortality rate of 3.2 for the larger babies in the 3500 to 4500 g weight range and the 14.2 average reflects the fact that 84 per cent of the perinatal deaths were of smaller babies under 3000 g and 60 per cent of babies under 2500 g in 1973. Swedish perinatal mortality fell further to 11.3 in 1975.

Birthweight distributions for Britain and Sweden are contrasted in Table 1.2. More than one half the difference between the lower Swedish and higher British perinatal mortalities is attributable to the better Swedish birthweight distribution. In Table 1.3, a simplification of Table 1.2, births in Sweden, Britain and Scotland are divided between higher mortality, low mortality and optimum ranges.

FIGURE 1A

PERINATAL MORTALITY BY BIRTHWEIGHT SWEDEN 1973 109,279 BIRTHS (1)

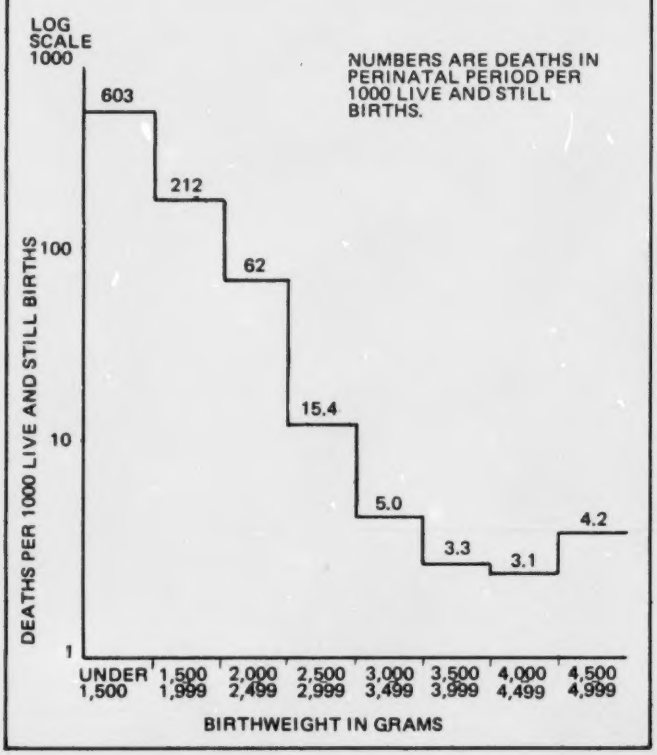


Table 1.3

DISTRIBUTION OF NUMBERS OF BIRTHS BETWEEN HIGHER MORTALITY AND LOW MORTALITY BIRTHWEIGHT RANGES; SWEDEN, BRITAIN AND SCOTLAND

	Percentages of all babies		
	Sweden (1) 1973	Britain (2) 1970	Scotland (3) 1974
In higher mortality birthweight ranges below 3000g	16.4	25.8	26.5
In low mortality birthweight ranges 3000 to 5000g	83.6	74.2	73.5
In optimum birthweight range 3500 to 4500 g	46.7	33.6	32.9

Unfortunately the National Birthday Trust Fund surveys of 1958 and 1970 have been misleading on one point. All birthweights over 4,000 g were aggregated and thereby hid the great merit of the 4,000 to 4,500 g range. (2) (4) The 1958 survey described the 3000 to 4000 g range as "optimal" and the 1970 survey showed the 3500 to 4000 g range to be optimal. Neither survey used the 4000 to 4500 g range. The more comprehensive Swedish and Scottish data show the 3500 to 4500 g range to be optimal on closer analysis.

The Canadian and United States distributions of birthweight are compared with the Swedish in Table 1.4. Canada and the U.S.A. are two countries with national incomes per head among the highest in the world. Canada has nevertheless 31.1 per cent and the U.S.A. 26.3 per cent of babies in the higher mortality birthweight brackets below 3000 g compared with England and Wales at 25.8 and Sweden 16.4. There are manifestly many factors other than the wealth of nations that determine the health of a country's women of reproductive age.

Table 1.4

PERCENTAGE DISTRIBUTION OF BIRTHWEIGHTS: SWEDEN, CANADA AND U.S.A.

	Sweden (1)	Canada (5)	U.S.A. (6)
Under 1500 g	0.8	1.0	1.2
1500 to 1999	0.9	1.5	1.5
2000 to 2499	2.8	6.2	5.1
2500 to 2999	11.9	22.4	18.5
3000 to 3499	33.9	40.3	38.0
3500 to 3999 optimum range	53.6	22.8	26.8
4000 to 4499 for survival	13.1	5.0	7.5
4500 to 4999	2.4	0.7	1.4
Over 5000	0.3	0.1	
Total	99.7	100.0	100.0

BIRTHWEIGHT AND SURVIVAL IN THE FIRST YEAR OF LIFE

It may be asked whether the best birthweight range from 3500 to 4500 g is perhaps peculiar to Sweden, Scotland or the Nordic countries. The United States 1960 Live-Birth Cohort, which included 60,773 white deaths and 17,557 non-white deaths, using linked records did not include stillbirths but covered deaths during the first year of life in much detail. Table 1.5 shows death rates by birthweight for the first month of life, or neonatal mortality, for white and non-white populations. For the U.S. white population it is seen again that the optimum weight range, as in Sweden, is from 3,501 to 4,500 g (8lb to 10lb). However for the U.S. non-white population the optimum birthweight range is from 3,001 to 4,000 g (7 to 9lb). This difference between the optimum ranges for the white and non-white populations is probably socio-economic. Among poor populations with a history of poverty there are, for example, women who have had rickets in childhood and have a deformed pelvis or are very small. There is evidence of lower optimum birthweight ranges among poor populations in developing countries. (8)

Table 1.5

NEONATAL MORTALITY BY BIRTHWEIGHT: U.S.A. 1960 LIVE BIRTH COHORT (7)

60,773 white deaths 17,557 non-white deaths

deaths during first month per 1000 live births

Birthweight range g	White population	Non-white population
1,001 - 1,500	555	434
1,501 - 2,000	198	130
2,001 - 2,500	45.0	30.1
2,501 - 3,000	10.1	9.4
3,001 - 3,500	4.4	6.4 optimum range
3,501 - 4,000	3.3 optimum	6.6 for survival
4,001 - 4,500	3.6 range for	10.1
4,501 or more	7.7 survival	16.3

The California Department of Health have analysed neonatal mortality by birthweight for 1,424,637 single live births as shown in Figure 1B. (9) In this large study 67.8 per cent of the population was classified as "white non-Spanish" and 32.2 per cent were either Spanish, many being poor immigrants from Mexico, or negro or they belonged to some other ethnic group. The slight rise in neonatal mortality in the 4251-4500 range to 3.1 from 2.1 in the 3751-4000 range was largely attributable to these minorities. "White non-Spanish" female babies with birthweights in the 4251-4500 (9½ to 10lb) range achieved the very low neonatal mortality of 1.8. The optimum birthweight range for the white Spanish babies was indeed 3250 to 4250 g, 250 g lower than for the white non-Spanish. It is seen again that the upper limit of the best birthweight is somewhat lower in poor populations. It may, however, also be inferred from the very low neonatal mortalities of 1.8 or even 3.1, that there are only very small percentages of women and babies disadvantaged by birthweights in the 4000 to 4500 g (9 to 10lb) range.

All these studies show small increases in mortality at very high birthweights and it is known that women with some disorders such as diabetes may produce very large babies. However the numbers are very small. The U.S. Live-Birth Cohort data based on 79,819 infant deaths under 1 year suggests 3.7 deaths in 1000 were associated with excessive birthweight in the white population. (7) In the same population 687 in 1000 deaths were associated with less than optimum birthweight. For every baby that was born too heavy 185 were too light. The advantage of high birthweight continues after the

FIGURE 1B

NEONATAL MORTALITY BY BIRTHWEIGHT CALIFORNIA 1966–1970 1,424,637 SINGLE BIRTHS, 15,685 NEONATAL DEATHS (9)

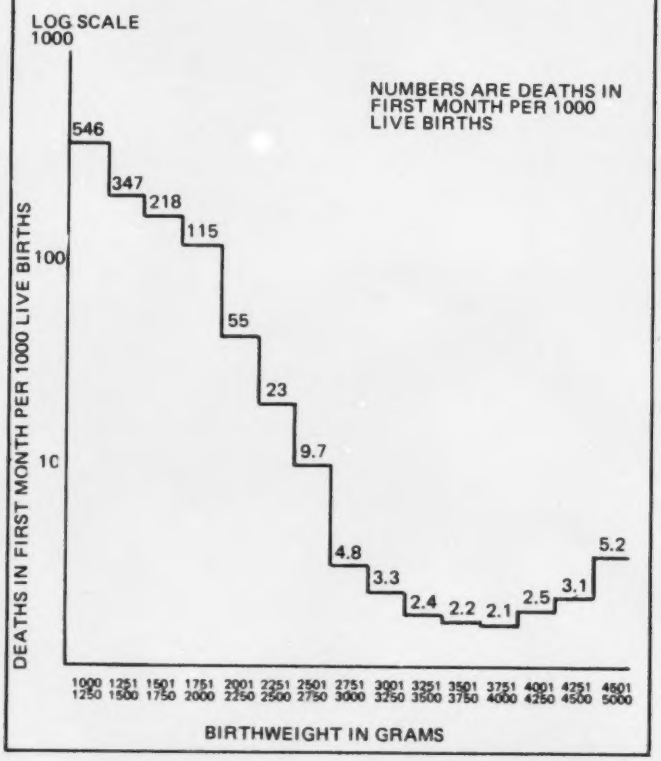
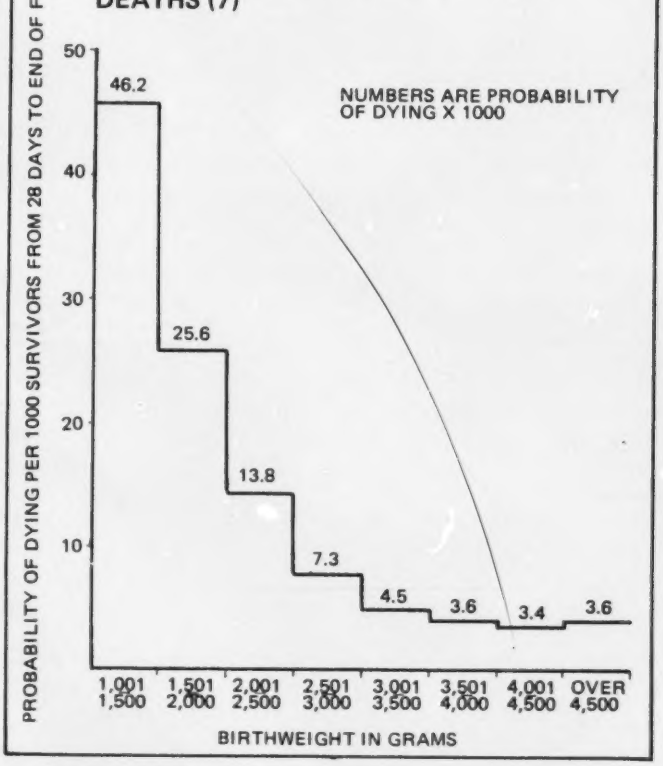


FIGURE 1C

POSTNEONATAL MORTALITY BY BIRTHWEIGHT U.S.A. 1960 LIVE-BIRTH COHORT 28,708 POSTNEONATAL DEATHS (7)



end of the first month of life. For the U.S.A. the 4,001 to 4,500 g birthweight range showed the lowest postneonatal mortality of 3.4 as shown in Figure 1C.

The Pan-American Section of the World Health Organization undertook a study of infant mortality in sixteen areas of eleven nations including U.S.A. and Canada. (10) In the different areas the percentage of postneonatal mortality attributable to babies with birthweights less than 3000 g ranged from 43 to 71 per cent. Among the conclusions of this survey was the need for "more attention than in the past to the weight group 2501-3000 g", to the "reduced vitality" of babies born into this sub-optimal weight bracket and to the reduced capacity of these babies to cope with an "unfavourable environment".

LOW BIRTHWEIGHT AND SUBSEQUENT HANDICAP

W.J. Little, one of the fathers of developmental medicine and child neurology, writing as early as 1862 described the association of cerebral palsy and mental disorders with low birthweight (11); 110 years later the United States Department of Health, Education and Welfare summarised the first 500 research papers from the United States Collaborative Perinatal Study of 56,000 babies born in fifteen American university-affiliated maternity hospitals:

> "The importance of low birth-weight as a determinant of perinatal death, neurologic abnormality and intellectual retardation has been one of the study's key findings to date". (12).

It must not be assumed that low birthweight is necessarily a cause of either the mortality or handicap. There may often be a common antecedent cause, such as infection, of both the low birthweight and the mortality or morbidity.

However low birthweight babies are more easily damaged at delivery and succumb more easily to infection and have other difficulties. Low birthweight is a valuable indicator whatever the chain of causation in particular cases. Low birthweight has been shown to carry an increased risk of cerebral palsy, epilepsy, autism, blindness, deafness and mental subnormality. The risk of handicap is very low for babies in the optimum birthweight range but begins to increase at birthweights below 3000 g and increases more and more as birthweight falls, the risk being more or less proportional to the mortalities given in Table 1. 1. 2500 g is the conventional threshold of "low birthweight". However the risk of neurological deficits is higher in the 2500 to 3000 g range than it is for larger babies, and this weight range is important as in Britain it includes some 18.9 per cent of all babies.

Handicap is not an inevitable consequence of low birthweight in the individual case. Many of the unfortunate consequences of low birthweight can generally be prevented by special or intensive care after birth and by very careful mothering throughout infancy. However in most countries, including Britain, many babies of low birthweight are not born in hospitals with modern equipment or staff for the care of very frail babies. Birthweight distributions provide one indication of the intensive and special care facilities needed in any community and therefore of the expenditure required.

Small, frail babies also only too often do not return to homes with the parental time, money or facilities which such babies really need. Low birthweight, frail babies cause much anxiety, disappointment and parental distress.Neurologically abnormal children often have lower thresholds to stress and this in particular causes parental distress and results in the mother becoming tense and anxious. (13). Studies have shown 20, 28 and 32 per cent of abused children as having had low birthweight. (14). Child abuse is itself an important cause of neurological handicap. These extreme cases of infants born into what proves to be a hostile environment and the four or more times greater risk of abuse among the low birthweight, frail babies, shows forcibly the cumulative character of much handicap. The big, strong, responsive baby, the pride of his parents, is more likely to be well looked after although it is the low birthweight frail baby who needs more affection, more constant care, more medical supervision, more attention to hygiene, more warmth and more shielding from infection.

The British National Child Development Study of 11,000 seven-year-old children showed the greater vulnerability of the low birthweight baby to an unfavourable environment and a report from the National Children's Bureau concluded:

> "An important finding is the extent to which social environment may mitigate the effects of adverse perinatal factors. The corollory of this is that socially disadvantaged groups in the community are much more vulnerable to certain adverse perinatal events." (15).

BIRTHWEIGHT DISTRIBUTIONS AS INDICATORS OF MEDICAL AND SOCIAL NEEDS

Distributions of birthweight and length of gestation are important indicators of perinatal health and of the health of women bearing children and also of the effectiveness of the supporting services. Throughout much of Europe and North America and in Scotland they are recorded as part of birth registration procedure or hospital records. Birthweight and gestation length are now being collected in England and Wales. (16).

In some countries these early records have been expanded to include paediatric assessment of infant health during the first 8 days or so of life and such records include weight and gestation. In some places visited in Finland, Sweden and France the data were found to be available at very short notice.

The British Court Committee recommended that:

> "High priority should be given to research into aetiology of handicapping conditions, and into the regional and social class variations in perinatal mortality and morbidity." (17).

Both regional and social class variation in perinatal mortality and morbidity are tightly correlated with birthweight distributions. Table 1.6 partitions perinatal mortality to show how far it was attributable to babies with birthweights above and below 2,500g in Surrey and Manchester, and is an example of the use of birthweight data as indicators of medical and social need.

Table 1.6

PERINATAL MORTALITY PARTITIONED BETWEEN BABIES WEIGHING MORE OR LESS THAN 2500 g: MANCHESTER AND SURREY COMPARED WITH ENGLAND & WALES AND BRITAIN AVERAGE

	Manchester 1971	Surrey 1971	England & Wales 1970	British Births (2) 1970
Babies weighing over 2500 g only	8.7	9.2	9.4	7.9
Babies weighing 2500 g or less only	20.2	9.9	14.1	13.5
Total perinatal mortality rate	28.9	19.1	23.5	21.4
Percentage of babies weighing 2500 g or less	10.3	4.3	7.5	6.8

Manchester compared with Surrey has over twice the percentage of babies with birthweights under 2500 g and over twice the number of deaths of these small babies. The higher perinatal mortality in Manchester compared with Surrey is wholly explainable in terms of the larger number of small babies. It can be inferred that much of the regional variation in perinatal mortality reflects different birthweight distributions. Table 1.7 shows the same partitioning of perinatal mortality for Cambridgeshire and Isle of Ely, West Riding and Glamorgan.

Table 1.7

PERINATAL MORTALITY PARTITIONED BETWEEN BABIES WEIGHING MORE OR LESS THAN 2500 g: CAMBRIDGESHIRE & ISLE OF ELY, WEST RIDING AND GLAMORGAN 1971

	Cambridgeshire & Isle of Ely	West Riding	Glamorgan
Babies weighing over 2500 g only	8.2	8.0	10.7
Babies weighing 2500 g or less only	6.8	13.7	16.3
Total perinatal mortality rate	15.0	21.7	27.0
Percentage of babies weighing 2500 g or less	3.7	6.2	7.7

West Riding and Glamorgan compared with Cambridgeshire and Isle of Ely had about twice the percentage of babies under 2500 g and twice the number of perinatal deaths of these small babies. The differences in overall perinatal mortality mainly reflects different prevalences of low birthweight. Both Tables 1.6 and 1.7 are based on data in Medical Officer of Health reports which are no longer published.

The regional birthweight distributions partly reflect different social compositions of the populations. Table 1.8 shows the social class association of birthweight from the first volume of the British Births Survey 1970.

This strong association of low birthweight with social class has disappeared in both Finland and Sweden except that the fatherless condition in both countries is still associated with a somewhat higher prevalence of low birthweight and a somewhat higher perinatal mortality, but in no way comparable to the perinatal mortality of illegitimate children in Britain of 28.2 in 1972. (19).

A reduction in the regional and social class disparities in perinatal mortality and morbidity absolutely requires a reduction in the regional and social class differences in birthweight distributions. Good records of birthweight distribution and lengths of gestation are essential to define the task in each area

Table 1.8

LOW BIRTHWEIGHT BY SOCIAL CLASS: BRITAIN 1970 (18)
16,815 births

Social Class	Percentage 2500 g or less	Percentage 3000 g or less
I & II	4.5	19.0
III	5.6	23.7
IV & V	8.2	27.3
Single, widowed, divorced, etc.	9.5	33.3

and to mark progress. Low birthweight percentages are a statistically much more sensitive indicator than perinatal or infant mortality because they provide larger numbers. The wards of British cities have typically populations of from 12,000 to 40,000 with from 150 to 600 births a year. Taking Birmingham as an example the number of infant deaths per ward in 1971 averaged 8 with a range from 1 to 34. These numbers are subject to the random variations of small numbers. But the number of births under 2500 g are generally four times higher and births under 3000 g are twelve to sixteen times higher than infant deaths, and random variations are lower. The percentage of babies who are born too small, and particularly the percentage below 3000 g, are therefore more sensitive indicators than mortality of the health of women of reproductive age and of the flow of an important part of new handicap. They may be used for following the progress of small communities with 10,000 or so inhabitants, as well as much larger populations.

Tables 1.2, 1.3 and 1.4 comparing the birthweight distributions of Sweden, Scotland, Britain, U.S.A. and Canada show that Sweden has a smaller problem than the other four countries. This is well known and is perhaps too frequently dismissed in Britain as being attributable to Sweden's higher standard of living. The reverse is also true; the higher standard of living in Sweden is partly to be explained by the smaller burden of health casualties and of social problems related to health which Sweden has to carry. Sweden has a much smaller percentage of people of working age who are seriously ill and need to be hospitalised or who die untimely, and probably therefore too of people who are only moderately or slightly physically or mentally ill. Sweden's high standard of living today is partly a consequence of excellent maternity and child care services over a long period.

CHAPTER TWO

EUROPEAN DEVELOPMENTS IN THE PREVENTION OF PRETERM BIRTH

CLAIMS FOR NEW DRUGS

A West German obstetric journal in 1974 invited six professors, four from West Germany, one from Vienna and one from France to participate in a written symposium on the use of drugs for stopping or postponing labour. We call these drugs "delaying drugs" in this study. This is an important part of the growing subject of the prevention of preterm birth and spontaneous abortion, which poses many problems. The following translation of the introduction to this German symposium states some of these problems:

> "We are today able to stop or postpone labour by the use of drugs in a variety of ways. Nevertheless we consider that the treatment of preterm labour in general will only improve if the cases meriting treatment are diagnosed early enough. The problem is no longer how to prevent preterm birth by drug treatment; the problem is an organisational matter for the health care system. Early diagnosis must be the responsibility of the antenatal care service. A cerclage at the right time is necessary and will improve results in some cases (and also requires early diagnosis). Preterm birth is responsible for 25 to 35 per cent of all perinatal casualties, which can only be reduced to any substantial extent by reducing the perinatal mortality of the babies now born too soon. In this context the treatment of threatened preterm birth with drugs for stopping or postponing labour now has an outstanding place. Many and diverse results of trials have now been reported. It is therefore the purpose of the present written symposium to attempt to draw up a balance sheet and to open out the subject." (1)

The six university centres participating in this symposium were using only the two drugs, fenoterol and ritodrine, for stopping uterine contractions and delaying labour. Many other drugs had been tried and abandoned. The differences in the side-effects produced by these delaying drugs are substantial. The two preferred drugs, fenoterol and ritodrine, were stated to have been selected for the least side-effects associated with doses adequate to stop labour (1). German papers as recently as 1974 stated that fenoterol was the best drug in the sense that it stopped uterine contractions in the smallest doses and with the smallest increases in maternal and fetal heart-rates (2).

There are major differences between countries in current practice and policies in the use of drugs for delaying labour. A letter from the United States Food and Drug Administration dated 13th May 1977 informed the writers that no drug has as yet been approved in the USA for the purposes of preventing premature labour. Approval has, however, been given for clinical studies on the efficacy of ritodrine in preventing premature labour. In Britain the Committee on Safety of Medicines in a letter to the writers dated 12th April 1977 stated that two drugs had been granted product licences for the management of uncomplicated premature labour and these were ritodrine and salbutamol (3). The Committee approved these drugs for their "quality, safety and efficacy". A leading article in the *British Medical Journal* on 30 April 1977 said that the trials of salbutamol lacked controls and that there have been no trials comparing the merits of different drugs with each other (4). This leading article mentions a number of drugs but not fenoterol, one of the two preferred drugs in use in Europe. One of the two drugs given product licences by the Committee on Safety of Medicines is not one of the preferred drugs in Germany. The German drug fenoterol regarded by some investigators as the best has no product licence in Britain and is not on sale (5). The German choice was based on German comparative drug trials and there have been no such trials in Britain. On the other hand the German comparative trials did not apparently include salbutamol, a drug manufactured in Britain.

This is an unsatisfactory situation that can only be resolved for Britain by adequate comparative drug trials on a substantial scale. A leading article in the *Lancet* in 1974 said:

> "Now we have agents which apparently will inhibit labour in a high proportion of cases, and the next task is to assess their value in terms of prognosis of the fetus and infant . . . . "
>
> "It is to be hoped that before these and other delaying drugs come into general use, the indications will be better defined and the possible dangers to mother and fetus clearly described." (6).

Three years later there have been no comparative trials in Britain. It is presumably because the United States Drug Administration is not happy that the possible dangers to mothers and babies have been adequately defined that approval of any of these drugs for preventing pre-term birth for use in the

USA has so far been refused.

The delaying drugs used to slow down or postpone labour have been the subject of trials in other countries for over twelve years. The earliest papers on the efficacy of these drugs that were convincing as to their effect but not as to their safety were published in the USA, based on animal experiments in Vienna in 1956 (7). Better drugs with less side-effects were subsequently made available. Fenoterol has been used since 1968. Some of the early work was undertaken at the Department of Obstetrics in Nijmegen in the Netherlands using a drug supplied by a German firm (8).

The German vernacular name for these drugs means "pain-preventer" or "pain-reducer" because they stop or reduce labour pains. The professors who contributed to the written symposium all approved the use of the drugs for reducing the frequency of uterine contractions during delivery or reducing the intensity of contractions or increasing the regularity of contractions or stopping contractions altogether in the event of foetal distress during delivery and to avoid the need for undue haste in deciding upon or preparing for surgical intervention. The delaying drugs have an important role in reducing the stress of delivery for both mother and child (9). However, the use of delaying drugs for these limited purposes for a few minutes or hours does not involve all the same considerations as their use for weeks or months to prevent preterm birth.

The first report of British trials of delaying drugs was from Churchill Hospital, Oxford in 1970 (10) The writers' conclusions were positive about the effectiveness of the German drug used which, however, was not one of the drugs now approved for use in Britain or preferred in Germany. Encouraging results of trials in Manchester (11) and in New Zealand (12) of the British drug salbutamol were published in 1973. The results of a double-blind multi-centre study of the Dutch drug ritodrine in hospitals in the Netherlands, Belgium, Austria and Spain were published in the *British Medical Journal* in 1971 (13). This paper reported the inhibition of labour in 80 per cent of cases. Ritodrine and salbutamol have been used increasingly in Britain since 1976 when the Committee on Safety of Medicines approved them for safety and efficacy.

About twenty papers on these delaying drugs were presented to the 5th European Congress of Perinatal Medicine in 1976 of which fourteen were German and the others Swiss, Hungarian, Austrian, Jugoslavian and Spanish. The largest trials covering over 1,000 births have been German.

The article in the *British Medical Journal* in April 1977 was headed 'Postponing Premature Labour' and began:

> "Prematurity is the most important avoidable cause of perinatal mortality and morbidity in Britain today. Premature delivery may occur because of a complication of pregnancy, but often it results from uncomplicated spontaneous premature labour which accounts for 30 per cent of low birth-weight babies".

The British article made no reference to the responsibility of the antenatal care service for early diagnosis, but began to expose the formidable case for obstetric research. It is apparent from the substantial literature on delaying drugs published during the last ten years that the right use of these drugs is of the greatest importance to women, to their children and to society. It is also apparent that the obstetric profession in Britain has not been supported by the necessary funds for drug trials and associated research.

The prevention of preterm birth has always been a purpose of obstetrics. The development of delaying drugs has only served to expand and develop the subject. Preterm birth can also be prevented in particular cases, by treatment of infection, by the cerclage operation if the reason for a premature birth is cervical damage, and in some cases simply by bedrest. The delaying drugs are just one more important weapon in obstetrics. An important additional means of preventing preterm birth is an important contribution to the prevention of handicap of perinatal origin. What are the implications for Britain? Drugs are now available which both delay and bring forward delivery. This prompts a number of questions. How far does preterm birth matter? How far is preterm birth associated with mortality and morbidity? What are the comparative risks from preterm and postmature birth? How reliably can the length of gestation be estimated and how far is it estimated correctly? How much do errors in estimation matter?

ASSOCIATION OF PRETERM BIRTH AND MORTALITY

It was thought for many years that unusually small babies were small because they were born too soon before they had had time to develop fully. It is now known that preterm birth is only one cause of low birthweight and that smallness may be the result of slow growth. While preterm birth and retarded growth are quite normally found together, particularly in the babies who die or are very ill, the means

of prevention are different but with a substantial overlap. We avoid the use of the word prematurity which came to be used for all babies who were too small.

The British Perinatal Mortality Survey 1958 found that more than half the perinatal deaths were of babies born before 38 weeks' gestation, and 60 per cent before 39 weeks (14). It is seen in Table 2.1, that mortality increases steeply as the length of gestation falls below 39 weeks. Forty and 41 weeks' gestation is the optimum length of gestation for the great majority of babies as seen for Britain in Table 2.1.

Table 2.1

PERINATAL MORTALITY BY LENGTH OF GESTATION: BRITAIN 1958 (14) 16,994 births

Gestation weeks	Perinatal mortality	
32	391.9	
33	326.0	
34	287.9	
35	160.9	
36	98.1	
37	55.5	
38	26.9	
39	16.4	
40	14.3	optimum range for survival
41	15.4	
42	22.7	
43	29.3	
44 and over	51.3	

FIGURE 2A

PERINATAL MORTALITY BY LENGTH OF GESTATION SWEDEN 1974 108,016 BIRTHS SCOTLAND 1974 53,398 BIRTHS

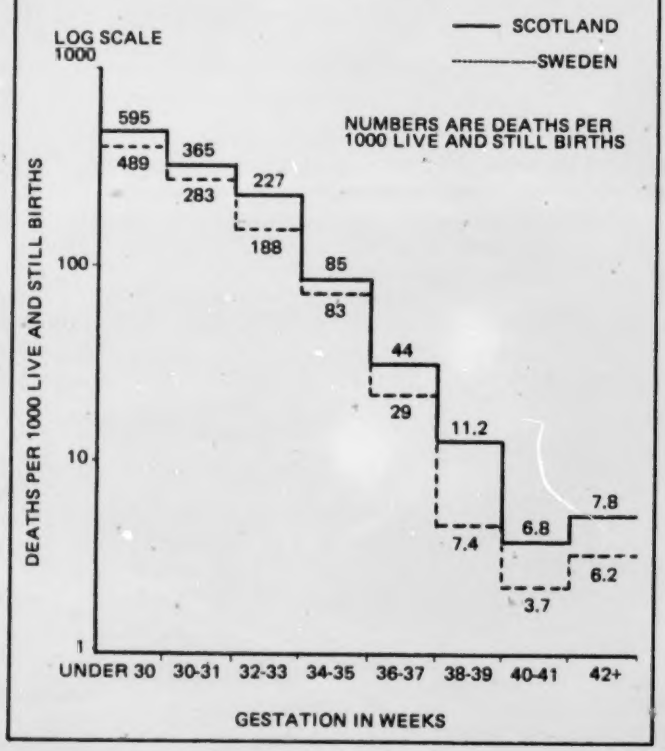
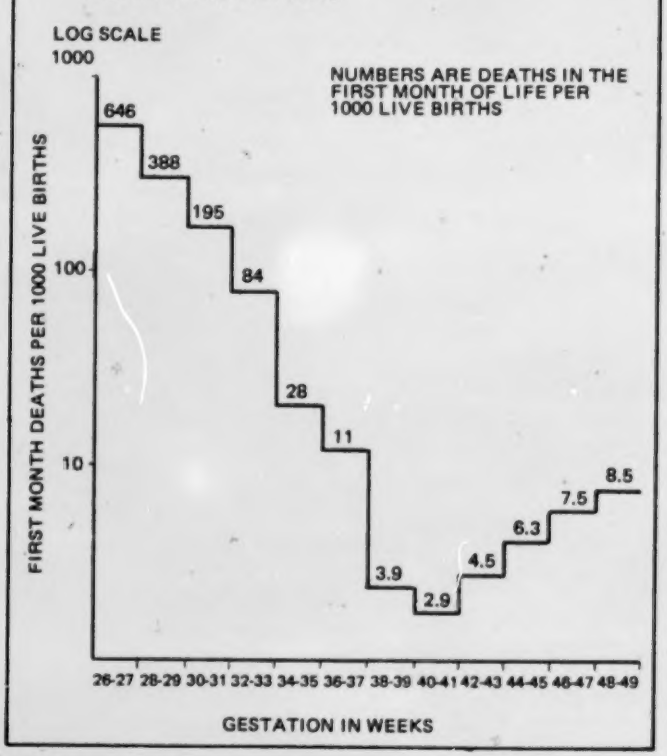


FIGURE 2B

NEONATAL MORTALITY BY LENGTH OF GESTATION: CALIFORNIA 1966-1970; 1,424,637 SINGLE LIVE BIRTHS; 15,685 NEONATAL DEATHS



Many surveys in other countries have confirmed 40 to 41 weeks as the optimum length of gestation. For example the Ontario Perinatal Mortality Study of 51,490 births showed a very similar result (15) the optimum range was again 40 to 41 weeks with a perinatal mortality 107 per cent higher at 38 to 39 weeks. Swedish returns for 1975 and 1974 with gestation recorded on 106,906 and 108,016 births also show 40 to 41 weeks as the optimum length. Perinatal mortality by lengths of gestation is shown for both Scotland and Sweden in Figure 2A.

The big Californian study also showed 40 to 41 weeks as the optimum length of gestation with a 35 per cent higher neonatal mortality at 38 to 39 weeks as shown in Figure 2B (16). This survey did not include stillbirths. Forty to 41 weeks is seen to be well established as the optimum length of gestation. It follows that one way of reducing reproductive casualties is to persuade more babies to be born at 40 or 41 weeks' gestation, that is at full term. It could be inferred from the Ontario Perinatal Mortality Study that if all the causes of preterm birth before 40 weeks' gestation disappeared then three-quarters of the perinatal mortality would disappear too. It cannot, of course, be assumed that the same result would be achieved by treating the symptom, that is by delaying birth by clinical measures until 40 or 41 weeks' gestation.

ASSOCIATION OF POSTMATURITY AND MORTALITY

All surveys show a slow rise in perinatal mortality with length of gestation beginning at 42 weeks. Recent surveys show less than one baby in 1,000 dying after reaching 42 weeks gestation, and not all these deaths can be attributed to the postmaturity. For every death associated with postmaturity (42 weeks and over) there were in Scotland 20 deaths associated with preterm birth (37 weeks and under). Table 2.2 shows the smallness of the contribution of apparently postmature births to perinatal mortality.

Table 2.2

PERINATAL MORTALITY ATTRIBUTABLE TO POSTMATURITY

Source	Number of Births	Overall perinatal mortality	All deaths at 42 weeks or longer per 1000 total births
Ontario Perinatal Mortality Study 1960 - 1961	51,490	26.3	1.51
Swedish Official Returns 1973	109,410	14.4	0.95
Swedish Official Returns 1974	110,041	13.3	0.92
Scottish Maternity Discharge Records 1974	58,071	21.7	0.62

The first volume of the British Births 1970 Survey has thrown much doubt on earlier estimates of the prevalence of post-maturity by publishing data on the uncertainty of the length of gestation calculated from mothers' reported menstrual dates. Table 2.3 shows the number of births at gestations supposed to be 42 weeks or longer and the percentage of cases where the length of gestation was recorded as uncertain.

Table 2.3

PERCENTAGE OF LONG GESTATIONS OF UNCERTAIN LENGTH: BRITAIN 1970 (17)

Length of gestation	Number of singleton births	Percentage of gestations of uncertain length
42	1285	18.7
43	313	40.0
44 or more	426	46.5

The first report comments:

> "It is possible that some of the abnormally long gestations may contain babies where the mother had not menstruated for some time before conception, for example if she had become pregnant shortly after a miscarriage." (17)

Secondary amenorrhoea has many causes and might have increased between 1958 and 1970 by one or two per cent from the increased use of oral contraceptives. The important conclusion, however, in the present context is that estimation of the length of gestation is again seen to be unreliable.

As only 1, 2 or 3 per cent of perinatal mortality is associated with gestation of 42 weeks or longer, while no less than 40 to 50 per cent of the 12 per cent of pregnancies alleged to last 42 weeks or longer are in fact of uncertain duration, the true extent and importance of the whole syndrome of postmaturity is in doubt. Only the British Births Survey 1970 made any attempt to estimate the accuracy with which these long gestations were recorded and it must be doubted whether any of the North American surveys recorded the length of gestation any more accurately. As the volume on the 1970 Survey said:

> "At the best, the length of gestation can only be an estimate and, even after birth, it is not possible to judge the babies' maturity accurately." (17)

There were 16,815 births in the British Births 1970 Survey but only 15,957 had gestation recorded. There were 16.9 per cent of births where the length of gestation was either uncertain or unrecorded. If the inaccuracy of recording increases with the length of gestation as shown in Table 2.3 it could explain some or all of these few deaths attributed to postmaturity, or that happened after 42 weeks gestation.

There have been a number of studies comparing assessment of length of gestation from date of last menstruation with subsequent clinical estimates of length of gestation after birth. Length of gestation based on dates given by the women concerned apparently results in underestimation of the length of gestation by up to ten weeks, and overestimation by as much as seven weeks (18) . However the U.S. National Center for Health Statistics in their National Statistics Analysis showed that estimates of preterm birth at under 37 weeks' gestation were some 50 per cent higher if based on dates of last menstrual period than if based on doctors' estimates, and there was over four times as much postmaturity of over 43 weeks from estimates based on dates than from doctors' estimates. They thought that the estimates based on dates were the more accurate (19) .

Postmaturity is a real syndrome and some babies are manifestly postmature after birth. But mortality attributable to postmaturity is certainly at the highest estimate only a very small fraction of that attributable to preterm birth. The true prevalence of post-maturity or of the associated mortality or morbidity is not known. The availability of new drugs for postponing delivery increases the need for more reliable knowledge about postmaturity and for better means of determining the length of gestation.

BRITISH TRENDS IN PRETERM BIRTH AND POSTMATURITY

The two surveys of the National Birthday Trust Fund 1958 and 1970 showed no improvement in the prevalence of preterm births between these dates as shown in Table 2.4 (17) (20).

Table 2.4

BABIES BORN TOO SOON: BRITAIN 1958 and 1970, SCOTLAND 1974

	Percentage born by weeks of gestation less than		
	37	38	39
British Perinatal Mortality Survey 1958: 15,685 births	5.3	9.7	19.5
British Births Survey 1970: 13,161 single births	6.4	10.5	20.7
Scottish Maternity Discharge Records 1974: 53,398 births	7.3	11.4	20.6

United States official statistics covering 40 States and the District of Columbia show a higher percentage than in Britain of preterm births before 37 weeks' gestation rising from 8.5 per cent in 1974 to 8.9 per cent in 1975 (21). Excluding negro infants, with the higher figure of 16.1 per cent, the figure for American white infants born preterm is still 7.6 per cent born at under 37 weeks.

It has been seen that there are reasons for supposing that postmaturity is even less accurately estimated than prematurity. Percentages of births supposedly postmature in 1958 and 1970 are shown in Table 2.5. It is seen that there was an apparent increase in postmaturity between 1958 and 1970, particularly in the number of very long gestations. The increase in the number of induced births from 3.1 per cent in 1958 to over 25 per cent of all births in 1970 made no visible contribution to reducing postmaturity. It may be that there has been a real increase in the amount of postmaturity since 1958, but it seems equally likely that the apparent increase may be the consequence of more women overestimating the length of gestation.

Table 2.5

BABIES BORN TOO LATE: BRITAIN 1958 and 1970, SCOTLAND and SWEDEN 1974

	Percentage born		
	Over 42 weeks	Over 43 weeks	Over 44 weeks
British Perinatal Mortality Survey 1958; 15,685 births	11.8	3.3	0.8
British Births Survey 1970; 15,957 births	12.7	4.6	2.7
Scottish Maternity Discharge Records 1974: 53,398 births	8.6	3.0	—
Swedish routine returns 1974: 108,016 births	15.2	—	2.6

It is noteworthy in Table 2.5 that Sweden, with the lowest perinatal mortality in the world, has a high percentage of gestations lasting for 42 and 43 weeks, while Scotland with a much higher perinatal mortality has fewer of these long gestations. However, both Sweden and Scotland have apparently very few deaths associated with unusually long gestation.

The United States official statistics for 40 States and the District of Columbia show 8.7 per cent of babies born at 43 weeks' or more gestation compared with 4.6 per cent for Britain in 1970 (21). The apparently much higher American prevalence of postmaturity seems as likely to be attributable to errors of estimation as to a real incidence of postmaturity.

THE EVALUATION OF NEW TECHNIQUES

Codes of good practice in the use of drugs are not the responsibility of the Committee on Safety of Medicines. The Committee exists primarily to protect doctors against misrepresentations by drug companies. Most drugs which are effective are also dangerous if misused. Neither the drug companies nor the Committee are responsible for the misuse of drugs. One German paper reporting on a successful series using delaying drugs concluded by saying that the delivery could presumably be delayed until a baby was dead although the writer had not heard of such a case. There is manifestly a hazard arising from present inability to estimate length of gestation accurately.

The report by the six German professors implied that 25 to 35 per cent of all perinatal casualties might be prevented by preventing preterm birth. The article in the *British Medical Journal* implied that 30 per cent of all low birthweight babies were the result of uncomplicated preterm labour and would have benefited from not being born before term. These are both reasonable hypotheses from the available data summarised above showing the association of preterm birth with mortality and morbidity. Some 37,000 babies were born before 37 weeks in England and Wales in 1976 alone. These 37,000 babies had a mortality about 17 times higher than the babies born after 37 weeks and were responsible for most of the deaths. A large number of lives and much associated handicap is at stake. Such reasonable hypotheses about the expediency of reducing the prevalence of preterm birth should lead to properly planned trials of the delaying drugs.

The many series now reported upon, mainly in German language papers, show that the new drugs are highly effective in delaying birth. Most of these papers are, however, summaries which are insufficiently comprehensive and contain too little detail to be wholly satisfactory. The results of studies in which the children born have been followed for several years have not yet been published although some of the children, alive only as a result of using these drugs, have reached the age of 10. Many questions remain to be answered as to when the drugs should be used and even as to which are the best drugs.

The article in the *Lancet* in 1974 argued for the proper evaluation of delaying drugs before they are put

into widespread use in Britain. The history of the use of accelerating drugs used in induction shows the wisdom of the *Lancet* view. The drugs used for induction have been in use in the world since the 1920s (22). The British Perinatal Mortality Survey found that 527 women or 3.1 per cent of the sample population had had induced deliveries using oxytocin in 1958 (23). In 1974 there were 260,000 inductions in England and Wales or 40.7 per cent of all births. New drugs and procedures can come to be used in Britain on a large scale without any acceptable evaluation being undertaken. The British Court Report 1976 commented on induction:

> "We would add that we are ourselves concerned that when new techniques are introduced, such as induction, the effects on both mother and baby should be fully evaluated before they are put into widespread use." (24).

There is obviously a danger that the new delaying drugs may diffuse into everyday use by the National Health Service without there being any satisfactory code of good practice based on a proper evaluation. Almost three years after the *Lancet* article the leading article in the *British Medical Journal* in April 1977 indicates that the satisfactory evaluation of delaying drugs in Britain is still in the future. Evidence that the prevention of preterm birth by delaying labour with the use of the new drugs results in more live and healthy babies is not yet available on a satisfactory scale from unimpeachable sources acceptable to the British public.

Whose responsibility is it then to ensure the evaluation of new medical procedures? The responsibility for the evaluation of new obstetric practices should rest with obstetricians and the Royal College of Obstetricians and Gynaecologists. However, the Royal College only commands the smallest fraction of the resources needed to evaluate important new procedures. Funds for such obstetric research should be provided by the National Health Service or by the Department. The failure to evaluate delaying drugs year after year is one outcome of the failure of the National Health Service year after year to support the obstetric profession with adequate research funds.

In the world as a whole obstetrics is a quite rapidly developing branch of medicine. It is bad administration not to have the right balance between expenditure on obstetric research and obstetric practice and can only hold back progress in obstetric practice. It is expensive in eventual consequences to public funds and unacceptable to parents to starve obstetric research to the point where the practising obstetrician has to introduce new drugs and procedures which have not been fully evaluated and even lacks adequate guidance on which is the best drug to use. Of course money for research is limited. However, the pay-off from improvements in obstetrics is probably greater in terms of saving of public money on the care of the handicapped over many years than any other branch of medicine, followed by neonatal medicine and paediatrics. It is these branches of the profession which have the totality of future lives in their hands.

There are other lessons to be learnt from the history of induction. The evaluation of a new procedure is a straight-forward and rewarding exercise when the procedure is reasonably new. The belated evaluation of a procedure already widely used is in contrast embarrassing to the point of being politically objectionable. There are powerful incentives for hiding the facts (24). The reasons for induction of birth in Britain are, for example, not published and yet, of course, these reasons are basic information essential for assessing the procedure. A code of good practice would, of course, have to discuss and advise on the indications for induction.

Codes of good practice protect both a health service and the medical profession and the patients. If one hospital uses induction very much more than another it poses the question which hospital is right. If the results to the patients are the same in the two cases this needs to be shown, because it is an unlikely coincidence, and if confirmed it would prompt the question as to whether one or other hospital is not wasting scarce resources. A code if adhered to protects against all such questions to which there is no end in the absence of a code. How is it that some other countries like Finland and Sweden induce birth altogether less frequently than Britain and yet have lower perinatal mortalities? A code will, of course, take the experience of other countries into account which it is exceedingly difficult for the single obstetric department to do today.

The history of induction points to another ingredient of progress namely the importance when introducing a new technique of systematic study of the casualties. The British Births 1970 Survey showed that 243 births out of a total of 13,310 were induced at under 38 weeks gestation; 20 per cent of all preterm birth was the result of induction. The Hospital Inpatient Enquiry 1972 found that 28 per cent of all babies weighing less than 2500 g were the result of induction. A strict discipline in the use of induction is part of the prevention of preterm birth and so of the prevention of handicap. It has been an excellent British tradition to undertake a "confidential enquiry into maternal deaths"; the reports of these enquiries have contributed to obstetric knowledge and good practice. It is, of course, the purpose of a code of good practice to reduce casualties to a minimum and it must therefore be based in part on a systematic study of the deaths and morbidity associated with use of the technique

in question for different purposes. A confidential inquiry into perinatal deaths following the use of induction or delaying drugs could contribute to progress as has the confidential inquiry into maternal deaths.

SOME QUESTIONS TO BE ANSWERED ABOUT DELAYING DRUGS

Advice on the use of delaying drugs conflicts on some important points. The professors who took part in the written symposium in 1974 were asked whether they used the drugs to prevent spontaneous abortions before 28 weeks' gestation (1). One professor replied "yes, if the foetus is alive and with excellent results". Another professor replied "yes, but only in cases of cervical insufficiency". Another professor replied "yes" and two replied "no" The literature of a British manufacturer says that "preparations should not be used for threatened abortion during the first or second trimesters of pregnancy" (25). In East Germany it is regarded as unethical not to use them after 20 weeks' gestation (26). A paper from a West German University on the prevention of preterm labour recommends the use of delaying drugs to stop abortions after 16 weeks' gestation but not before (27). Other papers show that the drugs are effective in preventing spontaneous abortion throughout most of pregnancy back to 6 weeks' gestation and probably earlier (28).

It has been shown that abortions at less than 12 weeks' gestation include a high proportion of abnormal foetuses with chromosomal defects (29). Prevention of first trimester abortions using drugs or cerclage is manifestly undesirable. Delaying drugs can indeed be used in such a way that they increase rather than reduce the flow of handicap, although rather few of the chromosomally defective foetuses would live. The same drugs are used in the treatment of asthma and bronchial spasms. There is therefore a danger of women taking the drugs accidentally during the first trimester. The delaying drugs are also reported as effective against dysmenorrhoea, further increasing the risk of accidental use during the first trimester of pregnancy (30). After 16 or 20 weeks' gestation this risk is much reduced. However there will still be a balance of advantage and disadvantage. The question still has to be answered as to whether delaying drugs should be used after 16, 20 or only 28 weeks' gestation. Trials are needed to compare the babies carried to term using drugs following threatened late abortion or preterm birth, with detailed epidemiological data on babies where the pregnancies were not extended by the use of drugs, and with babies with a spontaneous full-term delivery.

Evaluation of the use of delaying drugs is needed to provide guidance as to whether they should be used to continue pregnancy up to the 37th, 38th, 39th or 40th week of gestation. Perinatal mortality declines steeply up to the 39th week (14). Any conclusion must bear in mind that there is normally an error in the estimation of the length of gestation. Further study is merited on the accuracy of estimation of the length of gestation using different methods and any code of good practice should include recommendations on estimation of length of gestation. Any conclusion must also bear in mind that perinatal casualties attributable to being born too soon are 20 or more times more numerous than are attributable to being born too late, and that there is serious doubt about the prevalence or magnitude of the risk of postmaturity, a syndrome that merits further study.

The obstetrician now has a choice of three alternatives: he may decide not to intervene and let the pregnancy take its natural course; he may decide to induce birth and shorten gestation; or he may decide to delay birth and lengthen gestation. Much remains to be done to determine all the indications for and against the choice between these three alternatives in particular cases. These indications depend upon the condition of both mother and unborn child.

There is a point of time in the progress of labour when it is too late to use delaying drugs. After the membranes have ruptured there is a much increased risk of infection for both mother and baby and it is thought by many obstetricians to be unwise to prolong labour for very long. Furthermore, the hydrostatic pressure of the amniotic fluid is very protective for the baby. The anisotropic forces to which the baby is subject once the fluid has gone submit the baby and especially the skull to greater and possibly damaging stress. There are German papers recommending that the membranes should be maintained intact as long as possible (31). It is for these reasons that the artificial rupture of the membranes or amniotomy to induce labour or accelerate birth is discouraged except on very positive medical indications. Even if the membranes are still intact the delaying drugs by themselves fail if the cervix has opened too far. It was the need to administer delaying drugs before the rupture of membranes and before the cervix had opened too far which led the six professors to stress the onus on antenatal care services for early action which is discussed further in Chapter Four.

The relevance of maternal hypertension as an indication for the use of induction or delaying drugs merits re-consideration. The British Perinatal Mortality Survey 1958 showed that the risk to the unborn child diminished as gestation increased up to 40 weeks gestation for both normotensive and hypertensive mothers, but that death rates were higher at all lengths of gestation for babies of hypertensive mothers. The authors of the first report in their chapter 'Toxaemia in Pregnancy' concluded that:

> "The element of 'curtailed pregnancy' is the essential lethal factor in spontaneous immature delivery as well as in the other frequent obstetric complications of which toxaemia and antepartum haemorrhage are the most important". (32).

A 'curtailed pregnancy' is a preterm birth in other words. The 'curtailment' of pregnancy can be prevented today by delaying drugs, whereas induction results in more curtailment of pregnancy. Toxaemia in the context of this quotation was synonymous with maternal hypertension. The conclusion applied separately to the subclassifications of toxaemia used which were: essential hypertension, hypertension with toxaemia, mild toxaemia, moderate toxaemia, severe toxaemia and 'remainder'. Indeed, two weeks more in utero was more than equivalent to eliminating the apparent effects of hypertension on the baby. However, within the large total of hypertensive mothers there are small minorities where the pregnancy should be brought to an end in the interests of either mother or child. About one woman in 10,000 develops eclampsia and there were 12 maternal deaths from eclampsia in England in 1974 all of which might have been prevented by earlier termination of the pregnancy. 11 babies in 1,000 died in utero in England in 1974, as discussed further in Chapter Three and 5 in 1,000 will have been born to mothers with hypertension. However, these are small percentages compared to the 35 per cent of all women who were found in the 1958 survey to be suffering from hypertension. Moreover, as the first report stressed the majority of all perinatal deaths were associated with 'curtailed pregnancy' and hypertension was associated with some increase in the risk of a 'curtailed pregnancy'. Hypertension by itself, in the absence of other symptoms is, therefore, manifestly an inadequate indication either for the use of induction or of delaying drugs. It seems, indeed, that delaying drugs may be appropriate in many cases, but the curtailment of pregnancy in others. Reports that delaying drugs, depending upon the dose and the particular drug used, reduce blood pressure to a modest degree (33), or are beneficial for patients with pregnancy toxaemia (34) need to be examined by further research. An evaluation of the use of delaying drugs involves, therefore, at the same time a study of induction for some indications such as hypertension or antepartum haemorrhage.

There are French, German and Swiss studies showing that the delaying drugs under some circumstances increase the perfusion of the uterus and placenta with maternal blood (35). It is also claimed in other studies that these drugs promote the more active growth of the unborn child but this does not seem to be convincingly established. Growth retardation is such an important cause of pregnancy failure that a study of the effect of delaying drugs on the growth of the unborn child should be a research priority. Growth also depends upon the composition or nutrient content of maternal blood which must be taken into account by a research programme.

One reason for the death or illness of the preterm infant is the immaturity of the lungs leading to respiratory distress. There have been studies suggesting that the delaying drugs accelerate the maturation of the lungs of the unborn child. This is another subject meriting research.

There is a large number of studies of other side-effects of the delaying drugs but more such studies are needed (36). There has, in particular, been no adequate study published on the effects of these delaying drugs on the nervous system of the child.

It is important that delaying drugs should be evaluated before they are used in a variety of special circumstances. It is, for example, important that some deliveries take place in a major hospital with full equipment, but the woman concerned may live 50, 100 or many more miles from the hospital, too long a distance to travel in labour with the transport available. This is a problem particularly in thinly populated countries like Canada. There are three ways of ensuring that the delivery takes place in the major hospital nevertheless. The woman may be moved towards the end of pregnancy to a "patient hotel" close to the hospital; this is expensive and may not be acceptable if a woman has other children. The woman may be moved towards the end of pregnancy into the hospital and labour may then be induced. Alternatively the woman may stay at home until labour begins, and the labour can then be stopped temporarily using delaying drugs until the journey to hospital is over. The comparative merit of these three alternatives needs to be evaluated but there must be a suspicion that the third alternative will generally be preferable just because the risk of disaster from a preterm birth is at least 20 times the risk from postmaturity.

REDUCING PERINATAL CASUALTIES AMONG TWINS

The British Births Survey 1970 showed a perinatal mortality for multiple births, mostly twins, of 100.5 deaths per 1,000 live and still births compared with 21.4 for single births (37). Although twins were only responsible for 2.2 per cent of the births they were responsible for 9.5 per cent of all the perinatal deaths. The editorial team of the second report of the 1958 British Perinatal Mortality Study wrote a chapter on multiple births which concluded that:

> "The greatest advance in the reduction of mortality in twin births

would be a reduction in the incidence of premature labour, but as yet there is no universally successful method which will achieve this aim." (38).

In the 1970 Survey 6.8 per cent of the singletons but 51.8 per cent of the twins weighed 2,500 g or less.

In June 1977 the *British Medical Journal* published a leading article under the heading 'Preventing Prematurity in Twins'. At about the same time the leading East German obstetric journal published an eleven page paper under almost the same title (39). These two articles put opposite and irreconcilable points of view. The German paper concluded:

> "We now have the opportunity for the first time of reducing the prevalence of preterm birth, and the preterm birth of twins in particular".

The British paper concluded:

> "There seems to be no effective prophylaxis that can be offered to women expecting twins, nor are the prospects particularly bright".

The German paper said:

> "The central feature of the management of twin pregnancies is the prevention of preterm labour by the use of tocolytic drugs if labour pains begin prematurely, or more usually prophylactically, to ensure that preterm birth is prevented. The period for which the drugs are now taken varies from 3 to 10 weeks."

The British paper said:

> "The beta-sympathomimetics have important side-effects on the cardiovascular system and should not be used routinely until there is clear evidence of their effectiveness".

The German paper continued:

> "In the two years from 1972 to 1974 trials of the new procedures now in use were shown by Scholtes to reduce perinatal mortality in his sample of births by more than 50 per cent (from 11.5 to 5.0 per cent)".

The results of these first German trials of delaying drugs in twin pregnancies were presented in an address to the Congress of the German Society for Gynaecology in September 1974 in Wiesbaden, West Germany (40). The use of delaying drugs in the management of twin pregnancies is recommended in West Germany (41).

An earlier paper from East Germany argued that it was of the greatest importance to reduce the prevalence of preterm births among twins because of the large amount of neurological damage associated with the preterm birth of twins (42). This paper pointed to the success of Hungarian studies at the Medical University of Debrecen which had also succeeded in reducing perinatal mortality among twins by more than 50 per cent by delaying birth (43). The German paper argued that it was worth taking much more trouble to prevent the preterm birth of twins and from the Hungarian study it seemed that about three-quarters of the excess mortality associated with twins could be prevented.

The difficult practical problem was to ensure early enough diagnosis. Early diagnosis of multiple pregnancies is essential to success, as it is in most endeavours to reduce preterm birth. It is necessary to screen all women for a possible multiple pregnancy as soon as possible after twenty weeks' gestation if losses of twins are to be avoided. Electrocardiography is reported as providing a quick, harmless and reliable method of diagnosis.

Table 2.6

BABIES BORN TOO SOON: BRITAIN 1970 AND EAST GERMANY 1974

	Percentage born by weeks of gestation less than		
	37	38	39
British Births Survey 1970; 13,161 single births	6.4	10.5	20.7
East Germany 1974; 15,589 all births	3.3	6.4	13.8

The British *Memorandum on Maternal Care by General Practitioners* 1975 makes no reference to the importance of early diagnosis of multiple pregnancies even although they are responsible for about

10 per cent of all perinatal deaths.

Twins present other obstetric problems but preterm birth is the biggest threat to them of all. They are indeed an important component amounting in different populations to between 8 and 15 per cent of all the babies threatened by preterm birth. Table 2.6 contrasts the percentages of babies born preterm in Britain and in East Germany.

Bearing in mind that data relating to length of gestation is unreliable it is still noteworthy that the substantial difference between the two countries is consistent with two very different obstetric philosophies; Britain uses drugs to reduce the length of gestation while East Germany is a major user of delaying drugs to reduce the numbers of preterm births. The difference between the two countries may be even larger than shown in Table 2.6 as the East German figures include all multiple births (44). East Germany has had a lower perinatal mortality than England or Scotland for several years. The perinatal mortality of East Germany is not, however, as much below Britain as would be expected from Table 2.6 at least partly because there is rather more foetal growth retardation in East Germany.

Progress in a branch of applied science has been described as depending upon the speed of response to innovations. The article on twins in the *British Medical Journal* provides a textbook example of long response time. It was four years after fenoterol came into use in Germany before trials on twin pregnancies began. Five years later still trials with twin pregnancies have not begun in Britain and what amounts to current German medical practice is condemned in apparent ignorance of this practice and of the results of German trials. The long response time is apparently attributable to failure of communication. The British article used only one of the 21 references used by the German paper and was clearly written without a thorough search of the literature. Even without studying the literature it is also surprising that the writer did not consider that there should be British trials of these drugs. It is not suggested here that the results of German trials should be accepted uncritically as a guide for British practice. It is suggested that funds should be made available by the British Government to enable British trials of such new procedures to be undertaken by British obstetricians without inordinate and unnecessary delay.

REDUCING PERINATAL CASUALTIES FROM BREECH DELIVERY

Over 15 per cent of all perinatal deaths were found to be associated with breech delivery in both the 1958 and 1970 Surveys of the National Birthday Trust Fund. The prevalence of breech delivery increased from 2.3 to 2.7 per cent in these 12 years according to these two surveys. Assuming these percentages still applied to England and Wales in 1976 there will have been about 16,000 breech deliveries and 1,500 associated perinatal deaths in that year. Breech delivery increases the risk of perinatal death by a factor of 7.

The great majority of these perinatal deaths associated with breech delivery are of babies born preterm at less than 38 or 39 weeks' gestation and with birthweights less than 2500 g. In the 1970 Survey 22 per cent of breech deliveries happened before 37 weeks' gestation and these deliveries included most of the perinatal deaths. A trawl of over 100 European institutions showed that 40 per cent were attempting to prevent preterm birth in cases of breech presentation and of these 88 per cent were using delaying drugs (45). The writers have failed to find a report on the results of prolonging pregnancy in these circumstances and the lack of uniformity of practice pinpoints the subject as meriting early research. There are reports of series of breech deliveries of babies weighing over 2,500 g or after 37 weeks' gestation showing low casualty rates. A paper from Manchester on 453 cases over 2490 g reported only 5 deaths, or a perinatal mortality of 11.2 (46). A paper from the Netherlands on 440 cases all over 2499 g and with gestations over 37 weeks reported only 3 deaths, or a perinatal mortality of 6.8 per 1000 breech births (47). The prevention of preterm birth in cases of breech presentation is a sensible focus for preventive research.

East German studies show an increase in the prevalence of breech delivery to as high as 8 per cent following previous induced abortion (48). This is stated to be "manifestly" the result of preterm birth resulting from the damage to the cervix in the abortion operation. It is assumed that most of these babies would have turned round for normal presentation if the cervix had been able to retain them. If this is correct then these cases of breech delivery would not be prevented by delaying drugs but only by a cerclage operation as discussed in Chapter Four.

It must be doubted whether cervical incompetence is the whole explanation of the increased number of breech deliveries following induced abortion. Breech presentation is shown in a paper from Bristol to be strongly associated with an abnormal site of placental implantation (49). Many studies, and indeed a German book specifically on the disturbance of implantation, have shown an increase in faulty implantation following induced abortion or dilatation and curettage (50). It is not clear from this substantial literature how far faulty implantation is caused by damage to the endometrium or by infection, because in a large proportion of cases there is reason to suspect both causes.

Breech delivery, associated currently with 1,500 deaths a year and a larger number of cases of neurological damage including cerebral palsy, ought to be the subject of further research programmes. While a study of the rewards from preventing preterm breech delivery should be the focus of the research this is only part of the problem. Research programmes would include the problem of diagnosis and problems of management outside the scope of this study.

INFECTION CONTROL MUST ACCOMPANY USE OF DELAYING DRUGS

German papers contain many warnings against using delaying drugs to prevent preterm birth without also attacking any associated infection with the right antibiotics (51). One contribution to a recent American symposium lists thirteen types of infection that cause preterm birth and gives 70 references (52).

Cervical damage resulting in cervical incompetence appears frequently to facilitate infection and to reduce the protection of the membranes against infection. Even when the cervix is not damaged, infection is one established cause of spontaneous abortion and preterm birth, so that the use of delaying drugs without treating the infection is in one sense suppressing a symptom without treating the cause which may continue to have other pathological consequences.

There is indeed a growing number of papers showing that by a systematic attack on infection in pregnancy, including bacterial cultures and selection of antibiotics, impressive reductions in the prevalence of spontaneous abortions and preterm births are possible without delaying drugs or cerclage (53). It cannot indeed be good practice to prevent preterm birth by the prolonged use of these drugs if the same result could be achieved by successfully treating an infection.

Infection is a major cause of damage to the placenta. There are many studies showing such damage to the placenta as responsible for foetal hypotrophy or growth regardation. Infection is therefore responsible not only for preterm birth, but also for failure of the foetus to grow. It may, also from this point of view, do more harm than good to prevent preterm birth without treating the infection.

When everything has been done to evaluate the use in Britain of delaying drugs their right use in practice will only have begun. As the six professors who contributed to the written symposium emphasised, early diagnosis then becomes the crux of the endeavour to use delaying drugs for preventive purposes. The responsibility for early diagnosis then falls on antenatal care services. The prescription of delaying drugs is also then only one thing that may need to be done. Infection control is another. In some cases a cerclage operation is essential. A Swedish monograph concluded:

> "Surgical closure of the cervix may be a woman's only chance to have a living child" (54).

The responsibility for diagnosing the need for a cerclage operation in time also falls on antenatal care services, as does also the responsibility for diagnosing twins in good time.

Before discussing further this essential role of antenatal care in preventing preterm birth in Chapter Four, it is emphasised in Chapter Three that there are many babies who are not only born preterm but are also growth-retarded and that there are some babies who do not benefit from prolonging pregnancies.

CHAPTER THREE

SOME LIMITATIONS ON THE USEFULNESS OF PREVENTING PRETERM BIRTH

TOO SMALL AND PRETERM

The majority of babies who die are both born too soon and are also too small; they are both preterm and growth-retarded. The Ontario Perinatal Mortality Study showed that 67 per cent of babies who died were born before 38 weeks' gestation and over 68 per cent of babies who died weighed less than 2500 g (1). Sixty per cent of all the babies who died in this survey were both born before 38 weeks' gestation and weighed less than 2500 g.

The weight distributions of the babies who die and who survive are essentially different. The percentage weight distributions of the dead and of the survivors, at 36 to 37 weeks' gestation only, are for example contrasted in Table 3.1. It is seen that there are much higher percentages of perinatal dead in the lower weight ranges. Data on other lengths of gestation show that it is over-whelmingly the smaller babies who die and the larger babies who survive at each length of gestation.

Table 3.1

PERCENTAGE WEIGHT DISTRIBUTIONS OF BABIES DYING OR SURVIVING THE PERINATAL PERIOD BORN AT 36 TO 37 WEEKS' GESTATION: ONTARIO PERINATAL MORTALITY STUDY 1960 to 1961 (1)

51,490 births, 1,356 perinatal deaths in survey
2,793 births, 156 deaths at 36-37 weeks' gestation

Birthweight range in grams	Percentages Dying in perinatal period	Surviving perinatal period
Under 1,000	0.7	0
1,000 - 1,499	12.5	0.2
1,500 - 1,999	21.7	3.4
2,000 - 2,499	31.6	22.2
2,500 - 2,999	18.4	38.8
3,000 and over	15.1	35.4
	100.0	100.0

Figure 3A shows the weight distributions of the dead and survivors for Scotland in 1974. It is seen that at 35 weeks' gestation the smaller babies die and the larger babies have a much greater chance of survival. The average birthweight of the babies who died and those who survived at different lengths of gestation is shown in Table 3.2, again from the Ontario Perinatal Mortality Study.

Table 3.2

AVERAGE BIRTHWEIGHTS BY LENGTH OF GESTATION FOR PERINATAL DEATHS AND SURVIVORS CONTRASTED: ONTARIO PERINATAL MORTALITY STUDY 1960 to 1961 (1)

51,490 births 1,356 perinatal deaths

Length of gestation weeks	Dying in perinatal period	Surviving perinatal period	Difference: birthweights of survivors minus that of deaths
	g	g	g
28 - 31	1297	1677	380
32 - 33	1590	2026	436
34 - 35	1854	2383	529
36 - 37	2285	2826	541
38 - 39	2724	3233	509

Table 3.2. shows that the average weights of the babies who died varies from 22.7 per cent lower at 28-31 weeks' gestation to 15.7 per cent lower at 38-39 weeks' gestation than the birthweights of the babies who survived. The great majority of the preterm babies who died at all lengths of gestation had birthweights 500 g or 1000 g or more below the most satisfactory weight for length of gestation as judged by survival rates.

FIGURE 3A

PERCENTAGE BIRTHWEIGHT DISTRIBUTIONS OF BABIES DYING AND SURVIVING PERINATAL PERIOD ALL BORN AT 35 WEEKS GESTATION; SCOTLAND 1974 58,017 BIRTHS, 793 AT 35 WEEKS

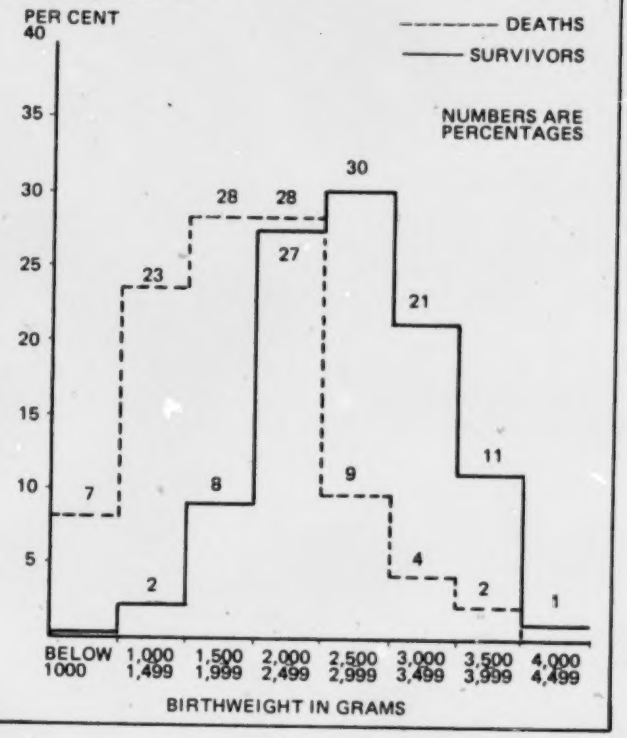


Table 3.3

NEONATAL MORTALITY: DISTRIBUTIONS OF BABIES BY BIRTHWEIGHT AND LENGTH OF GESTATION: CALIFORNIA INTRAUTERINE GROWTH STUDY 1966 to 1970 (2)

1,424, 637 single live births

Weeks of gestation completed		birthweight in grams 1,000 - 1,499	1,500 - 1,999	2,000 - 2,499	2,500 - 2,999	3,000 - 3,499	3,500 - 3,999	4,000 - 4,500
		deaths per 1,000 live births						
28	30	482	269	59	19			
30	32	368	248	82	19	5.8		
32	34	348	144	84	24	8.8	7.4	
34	36	311	113	38	18	6.5	6.3	.6.8
36	38	273	112	27	8.3	4.5	3.6	5.3
38	40	329	101	22	4.6	2.2	1.8	2.5
40	42	363	125	22	4.7	2.2	1.7	2.0

In California both birthweight and length of gestation at birth are recorded when births are registered. This enabled the Californian Department of Health to study the associations of birthweight and length of gestation and neonatal mortality. The report concluded that "birthweight has a strong influence on survival independently of gestational age":

> "Birthweight strongly influences survival for given gestations - the variation in mortality rates is as much as 300 to one at term - the converse is not true. At lower birthweights the range in mortality with gestation is only by about a factor of 2, increasing to about 3 or 4 at higher birthweights. It may seem paradoxical that either the weight-specific or the age-specific rates both show about the same variation, but that result follows from the correlation between birthweight and gestational age." (2).

This conclusion is illustrated in Table 3.3. It was again found that the lowest neonatal mortality was for over 40 weeks' gestation and 3500 to 4500 g birthweight. The maximum variation in mortality with gestation for a given birthweight in this Survey was by a factor of 5.2 for the babies weighing between 2500 and 3000 g. In contrast the mortality for a given length of gestation varied by a factor of 214 between the different birthweight ranges.

These conclusions place great emphasis on fetal growth retardation as a major factor associated with perinatal mortality. Figure 3B shows for Scotland the very different times during pregnancy at which different babies reach more or less safe weight thresholds. 2500 g is the conventional low birthweight threshold. Table 3.1, Table 3.3 and Figure 3A illustrate the very substantial fall in mortality when babies reach 2500 g at all lengths of gestation. There is a further fall in mortality as the 3000 g threshold is passed. 3000 g may be considered to be the minimum acceptable birthweight. It is seen in Figure 3B that both these thresholds may be reached by some babies at any time from the 30th to the 42nd week of gestation. If in Scotland all babies reached 40 to 41 weeks gestation then only 2 per cent of babies would still have birthweights under 2500 g instead of the 7.6 per cent of 1974, and there would be a corresponding fall in perinatal mortality. Alternatively perinatal mortality may be reduced by increasing the number of babies who reach these thresholds at every length of gestation at which babies are born.

Perinatal mortality is partitioned in Table 3.4 to show how much was attributable to babies weighing over 2500 g or less than 2500 g at birth in Scotland and Sweden. No less than 72 per cent of the difference between Scotland and Sweden is attributable to the larger numbers of these very small babies in Scotland and to these small babies being less viable in Scotland. Perinatal mortality is again partitioned in Table 3.5 this time to show how much was attributable to babies born too soon, before 38 weeks' gestation, in Scotland and Sweden. Fifty-one per cent of the difference between the two countries was attributable to the larger number of preterm babies in Scotland and again to these babies being less viable than in Sweden. However, taking these two tables together it is seen that fetal growth retardation is rather more important in the comparison of Scotland and Sweden than preterm birth as a cause of reproductive failure. Many of the casualties are, of course, babies born too soon and too small.

Table 3.4

PERINATAL MORTALITY ATTRIBUTABLE TO BABIES WEIGHING MORE OR LESS THAN 2500g : SCOTLAND AND SWEDEN

Infant deaths under one week plus stillbirths per 1,000 live and still births

	Scotland 1974	Sweden 1973	Difference between Scotland & Sweden
Babies weighing over 2500g only	7.9	5.8	2.1
Babies weighing 2500g or less	13.8	8.4	5.4
Total	21.7	14.2	7.5
Percentage of babies weighing under 2500g	7.6	4.5	3.1

Preterm birth is damaging in two different ways: if two babies have the same birthweight then the one born preterm has a lesser chance of survival as seen in Table 3.3; also the baby born preterm has had

less time to grow in utero than the baby carried to term and is therefore in the average case smaller and in a birthweight range with a higher mortality. Every extra week increases the likelihood of survival for the average baby up to 40 weeks gestation.

Table 3.5

PERINATAL MORTALITY ATTRIBUTABLE TO BABIES BORN AT SHORTER OR LONGER GESTATIONS THAN 38 WEEKS: SCOTLAND AND SWEDEN

Infant deaths under one week plus stillbirths per 1,000 live and still births

	Scotland 1974	Sweden 1974	Difference between Scotland & Sweden
Babies born after 38 weeks only	9.2	5.1	4.1
Babies born before 38 weeks only	12.5	8.2	4.3
Total	21.7	13.3	8.4
Percentage of all babies born before 38 weeks	11.4	9.7	1.7

PREVENTING PRETERM BIRTH WILL NOT BENEFIT ALL BABIES

About one fetus in a thousand dies in utero in each week of gestation during the third trimester. Figure 3C shows that, in Sweden at least, the risk of stillbirth increases slowly week by week during the third trimester of pregnancy. At the same time early neonatal mortality falls week by week until it equals the risk of stillbirth at 40 to 41 weeks gestation. Indeed these probabilities show that for the Swedish population as a whole there is less risk in utero until 40 weeks' gestation and it is then just marginally better to be born. Of course these two probability curves would be expected to cross at some point on biological grounds to indicate the right time to be born. It is of interest that they cross, as might be expected, at 40 to 41 weeks' gestation. At most lengths of gestation the risk of being born is seen to be enormously greater than the risk of dying in utero. The rise in mortalities over 42 weeks' gestation is based on rather small numbers for statistical significance and the many errors in estimating the length of gestation should also be born in mind, and indeed in the previous year the Swedish perinatal mortality at 42 to 43 weeks gestation was 5.3, identical to that at 40 to 41 weeks.

On the left of Figure 3C may be seen the risk of babies dying before term, say at 28 to 32 weeks' gestation, both for the baby born then and for the baby who is stillborn. It is seen that the probability of a baby dying if it is born is several hundred times the risk of dying in utero. It can be inferred that most of the very small babies weighing 1000 to 2000 g or less and born at less than 32 weeks' gestation, babies who now find their way into intensive care units if they are lucky, would be generally much better kept in utero. A Hungarian study included 38 babies threatened with birth at 29 to 32 weeks' gestation. With the help of delaying drugs it was claimed that 34 out of the 38 of these pregnancies were prolonged to term or near term (3). These are, of course, selected extreme cases. If these babies had been born at 29 to 32 weeks almost every one would have presented a serious neonatal problem, perhaps a quarter would have died and among those who lived would be some with handicaps.

However, in Sweden in 1973 there were 7.8 babies in every thousand who were stillborn taking all lengths of gestation together. There is manifestly this minority of babies, approaching one per cent, who might if their condition had been diagnosed in time have been saved by being born by caesarian section or otherwise. This demands, however, very good methods of diagnosis giving few false positives, because of the great increase in the risk of death for the average baby if he is born too soon. Delaying birth can increase the numbers of the stillborn if it is used in inappropriate cases. There is, therefore, a problem in any event of diagnosing the babies in time who are threatened with death in utero and this problem is aggravated if delaying drugs are widely used.

In Britain and elsewhere an examination weekly, or even more frequently of all women at risk is regarded as good practice towards the end of pregnancy. German papers recommend such an examination at least weekly for women on delaying drugs. The central feature of this weekly examination is a study to decide whether the fetal heart beat is normal and has not changed unduly since the last examination (4). This is often supported by a maternal blood-hormone analysis. A failure of the fetus to grow, or a failure of the mother to increase in weight and girth are warning signs (5). Declining fetal

FIGURE 3B

PERCENTAGES OF BABIES REACHING BIRTHWEIGHT THRESHOLDS AT DIFFERENT LENGTHS OF GESTATION: SCOTLAND 1974 57,429 BIRTHS

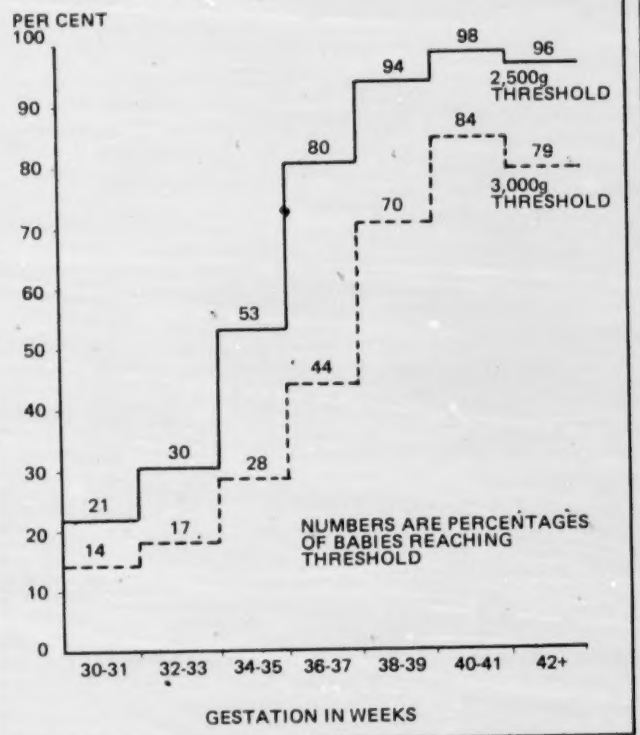
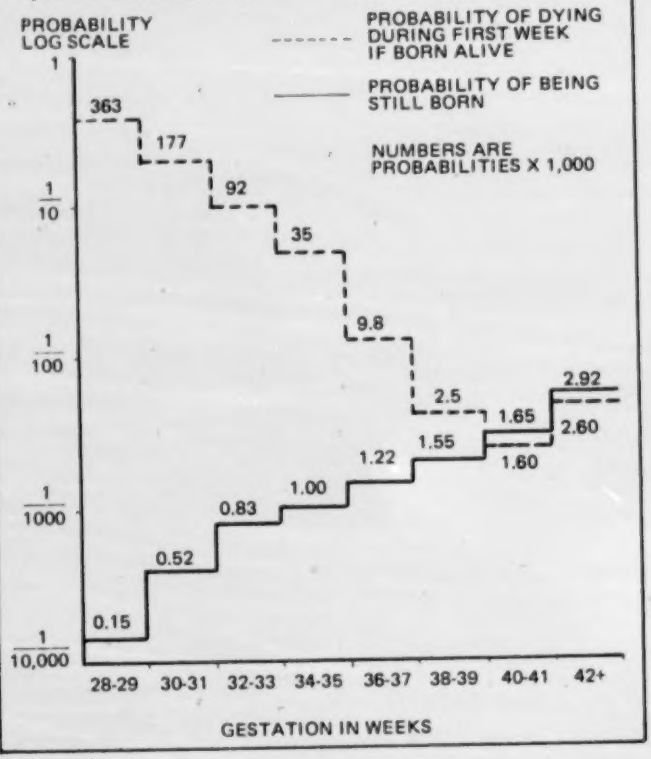


FIGURE 3C

PROBABILITY OF DYING DURING FIRST WEEK IF BORN ALIVE OR OF BEING STILLBORN BY LENGTH OF GESTATION: SWEDEN 1974 1,421 DEATHS 108,016 BIRTHS



movement before term is also a warning sign and some British obstetricians consider that the continuation of daily fetal movement is a useful indication of fetal well being. Methods of testing these movements have been developed in Britain (6).

Identifying the unborn baby at risk is, of course, a central problem in obstetrics. The free university of West Berlin has a department of perinatal medicine with a "Programme for the Prevention of Prematurity and Dysmaturity" (7). The programme includes prophylactic cerclage, the use of delaying drugs, the control of infection and much else besides. This programme also includes a weekly antenatal examination of all women on a risk list from the 28th week of gestation. This posed the problem of selecting women at special risk to be seen once a week. The West Berlin programme introduced a new numerical risk indicator for this purpose. There is experience of using such indicators in a number of countries and there are dangers in placing too much confidence in them. A numerical indicator based on maternal characteristics and obstetric history, sometimes called the "fixed factors", is apparently only able to predict about 60 per cent of low weight births and only then by placing a quarter or more of all women on a risk list. It is possible to do better than this by using the cumulative results of what are sometimes called "variable factors" found at antenatal examination (8). It has been shown for example on one population that the three so-called variable factors cervical insufficiency, identified infections and premature uterine contractions accounted for about one half of low weight births. It seems that the best techniques for estimating risk must be based on sequential procedures that yield a risk score that may change as a result of what is found at each antenatal examination, and may put a woman on to a risk list or remove her. Experience suggests that even then there will be a substantial proportion of failures to identify the babies found to be at risk in the event.

Growth retardation and its prevention is a major subject with, indeed, a larger literature than has been published about preterm birth. The Germans claim that the means for preventing preterm birth in the majority of cases are available. The prevention of foetal growth retardation remains another major subheading of the wider subject of the prevention of handicap. The prevention of growth retardation is outside the scope of the present study.

CHAPTER FOUR

RESPONSIBILITY OF ANTENATAL CARE SERVICES FOR PREVENTING PRETERM BIRTH

AN INADEQUATE CONCEPT OF ANTENATAL CARE

The English Department of Health and Social Security published the latest edition of their document entitled *Memorandum on Maternal Care by General Practitioners* in 1975. This document of guidance covering antenatal care, delivery, care of the newborn and postnatal care says nothing about the prevention of preterm birth. Although this document covers the whole perinatal period it does not mention that the majority of perinatal deaths are among the children born prematurely, or discuss the diagnosis of pregnancies where there is an enhanced risk of preterm birth, or emphasise the speed with which it is necessary to act if preterm birth is threatened. This emphasises how new is the concept of antenatal care as a service which has the prevention of preterm birth as a major part of its responsibilities.

The English Department is, however, aware of the deficiencies in antenatal care and, for example, supported a project, involving collaboration between northern and south-western areas to study the antenatal care provided to 1,402 patients and the outcome of the pregnancies. Three-quarters of the babies who died were born preterm and the report, published in the *Lancet* in 1976, commented:

> "When the best estimates of gestational age were compared we found that 20 of the 24 babies who died perinatally in the south-west were delivered by the 36th week, whereas in 7 of the 10 who died perinatally in the north-west the gestational age at delivery was 34 weeks. Notwithstanding inaccuracies in estimates of the likely date of delivery, why were so many of the early gestational 'lightweight' babies not identified sufficiently early during pregnancy, when the mother could at least have been sent to the consultant unit to confirm the risk of possible perinatal death? It certainly may not have been possible to maintain the fetus in utero in all instances, but the evidence does suggest that patients who were likely to have a shorter gestation were not identified by practitioners during the early antenatal phase." (1).

A paper from Bristol, England, reported on 358 pregnancies. Two hundred and eleven were selected for a past history of induced abortion and 147 for a history of spontaneous abortion (2). Thirty-five of these pregnancies ended in a premature delivery, 20 in a second trimester spontaneous abortion and eleven in a first trimester abortion. Ignoring these eleven first trimester abortions there were 55 preterm births or spontaneous abortions. Of the preterm babies nine died in the perinatal period although none of them had fetal abnormalities, two died later and several others needed intensive care. The British antenatal care system is not geared to prevent preterm births. There is probably nothing special about the Bristol experience except the careful recording of the facts. What is then necessary?

A CERVICAL EXAMINATION AT SIXTEEN WEEKS

In the German literature it is claimed that it is the availability of both the delaying drugs and the cerclage operation that has made it possible to prevent the majority of spontaneous abortions and preterm births. The cerclage operation has been available since 1950 (3). If the cervix has been damaged a cerclage operation to close the cervix may be essential and delaying drugs may not be effective alone. (4).

Recently in Czechoslovakia a device called the Mayer ring-pessary has been introduced which closes and supports the cervix without the need for an operation (5). Insertion of the ring-pessary is called in Czechoslovakia a "bloodless cerclage". At first only used on inpatients, trials have now been reported on its use in outpatient clinics on a substantial scale. It is claimed that it is a desirable alternative to cerclage and has a number of advantages including the speed with which it can be inserted and used without the need for a surgeon or operating theatre or anaesthetic and it does not damage the cervix. It is also cheaper than a cerclage operation. An assessment in Britain of all the circumstances in which such a ring-pessary may be a desirable alternative to a cerclage operation is probably merited. The Gottwaldov district of Czechoslovakia who have pioneered the ring-pessary are achieving a perinatal mortality of 12 per 1000 still and live births. This is one district using 100 per cent examination for cervical incompetence at about 16 weeks' gestation as part of antenatal care.

The head of the obstetric department of the Charite Hospital in Berlin addressed the 6th Gynaecological Conference of East Germany in 1976 on the prevention and treatment of preterm birth (5). This address placed great stress on the desirability of extending the use of the ring-pessary. It was claimed that the ring-pessary improves the prognosis following a cerclage operation, that it often makes an operation unnecessary and that it can be used with success after 3 or 4 centimetres dilatation of the cervix so long as the membranes are not ruptured. Unlike a suture the ring-pessary did no damage at all to the cervix.

A damaged cervix resulting in cervical incompetence rarely causes spontaneous abortion before 18 weeks' gestation (6). A cerclage operation between 14 and 18 weeks' gestation has prevented subsequent spontaneous abortion or premature birth in 90 to 95 per cent and more of reported series (6). In parts of Sweden and Germany as well as Czechoslovakia all women are now examined for cervical incompetence at about 16 weeks' gestation as a routine. Where there are grounds for suspicion the cervix is then examined weekly or fortnightly until it is decided to do a cerclage or that a cerclage is unnecessary. There has been a great increase in many countries in the frequency of prophylactic cerclage when there has been a previous history of spontaneous abortion or premature births or induced abortion (7). Complete reliance is not placed on the cervical examination, but a decision to do a cerclage which is considered by obstetricians to be a simple operation, follows a thorough discussion with the woman concerned about the risk of losing the baby and takes her obstetric history fully into account. Delaying drugs to prevent uterine contractions may be needed as well as a cerclage. Furthermore delaying drugs alone may be effective without the need for a cerclage.

The prophylactic or preventive course should begin at sixteen weeks with a thorough examination. There is an alternative course which is to wait for an emergency and then act quickly. There is a very long and sad record of what can then be done. The failure rate with the cerclage operation done as an emergency is 30 or 40 per cent in different series (8). There is similarly a failure rate using delaying drugs if they are administered too late after excessive dilatation of the cervix or rupture of membranes (9).

Several British surveys have shown that only about 50 per cent of women report their pregnancies by 16 weeks' gestation. Scottish returns for 1972 showed only 41 per cent attendance for antenatal care before 17 weeks' gestation (10). A survey in Aberdeen showed that there had been a decline in attendance for antenatal care before the 17th week attributable largely to very young women under 20 (11). A recent paper from the Midlands showed 8 women in 100 reporting for antenatal care at 28 weeks or later, and 24 per cent at 20 weeks or later; we have noted that a cerclage operation, when necessary, should be done at 16 to 18 weeks to give high rates of success (12). Other preventive measures, such as the use of diagnostic amniocentesis when there is a risk of chromosomal anomalies, are also frustrated by late reporting for antenatal care.

Several countries have shown that it is possible to ensure very high attendance for antenatal care early in pregnancy. Finland has reported over 91 per cent attendance before 16 weeks and France 96 per cent attendance for antenatal care before 15 weeks. Finland pays an antenatal care grant, which can be taken in the form of a complete layette, which is payable only on condition that a woman reports for antenatal care before 16 weeks. France also pays an antenatal allowance only payable in full subject to attendance for antenatal care before 15 weeks' gestation. The French grant is paid in three instalments and amounted to £172 (1,373.11F) after July 1976. These allowances are. of course, intended to meet some of the costs of pregnancy. Such allowances in France and indeed in other countries are increasingly arranged also to have a preventive medical purpose. French papers have stressed that the scope and depth of antenatal examinations need to be improved before the number is increased.

However in Britain neither general practitioners nor women themselves are responsible for all the delays. In the study from the Midlands pregnant women were being made to wait an average of six to seven weeks for their first hospital appointment for "non-urgent" cases (12). Women referred by general practitioners at 13 to 14 weeks' gestation had to wait until 20.5 weeks on average for this first hospital appointment. The inadequate staffing of the obstetric department of the hospital was the excuse for delays which were highly undesirable on medical and psychological grounds.

The thoroughness of antenatal care at the present time in Britain varies very widely from one place to another. The slow-moving type of service that exists in many places with inadequate examinations and inadequate records will do little to prevent preterm birth.

An examination for cervical incompetence at sixteen weeks also requires special training and is generally regarded as a task for the obstetrician or midwife.

DAY AND NIGHT EMERGENCY SERVICE ESSENTIAL

Prophylactic action is not always possible. Women can generally anticipate premature birth or late spontaneous abortion, particularly if instructed, in time for action to be taken, but they may be unaware of uterine action without instrumental aids (13). Portable instruments have been developed in Germany for use by antenatal care services (13).

Even in countries where delaying drugs are in general use once a late spontaneous abortion or premature birth is threatened very speedy action is essential. There has to be a referral point available at all times. An effective system must include a new role for flying squads ready for action day and night. The duties of such flying squads must be contained in the code of good practice covering, for example, when and how delaying drugs should be administered. Women must also have a medical record card or book which must be read before a flying squad can act. Delaying drugs are dangerous for some women,

for example with serious heart disease.

Some German clinics prescribe tablets which some women at risk keep at home. Papers are not clear on the circumstances when this is the best course. Tablets are slow to act and for rapid action delaying drugs must be injected or inhaled. The Germans have developed aerosols for use by local clinics in an emergency (14). Some clinics keep syringes ready filled to avoid a moment's delay. The names of women who may need help at awkward hours or if the local midwife is not available are sent to flying squads. Presumably some device such as the Mayer ring-pessary may also be required for particular cases.

A convincing analysis of the logistics of reaching pregnant women in time has not been found, and almost every one of the many published series show that an important percentage of women was reached too late. It would not seem to be difficult to determine what kind of service is necessary to reach women threatened with late spontaneous abortion or premature birth in time for action to be taken; the National Health Service should sponsor an operational research investigation. The leading article in the *British Medical Journal* in April 1977, entitled 'Postponing Premature Labour', failed to recognise that the ability of an antenatal care service to reach women in time is the crux of the problem of postponement and prevention.

The total co-operation of the woman concerned is essential. She can, of course, stay at home and do nothing until it is too late. Community midwives can best establish the necessary friendly relations and get the confidence of women at risk. Doctors however interested and concerned are generally too busy.

RESPONSIBILITY OF ANTENATAL CARE FOR INFECTION CONTROL

Infection can defeat all attempts to prevent late spontaneous abortions or preterm birth by using delaying drugs or cerclage. For example infection is considered to be a major cause of membrane rupture which largely if not wholly defeats attempts to prolong pregnancy (15). The earlier an infection is treated the better. The diagnosis and treatment of infection in pregnancy must be another important part of a code of good practice covering antenatal care. In British practice much infection remains untreated until the end of pregnancy. A study from Sheffield reported:

> "As regards history of vaginal discharge during the pregnancy under study 139 mothers (16.0 per cent) had complained of this and received treatment from their own practitioners including ten with trichomonal infestation. Details of this treatment were not available. A further 281 (32.4 per cent) admitted that they had an abnormal amount of discharge but had had no treatment." (16).

The French recommended good practice specifically includes treatment early in pregnancy in all such cases. The English *Memorandum on Maternal Care by General Practitioners* makes no reference to such vaginal discharge or leucorrhoea or its treatment. In the particular series of 868 pregnancies in Sheffield 3.7 per cent were suffering from trichomoniasis; a recent Glasgow series showed 9 per cent of the same disease (17). Trichomoniasis has been shown to be associated with enhanced rates of pregnancy failure (18). Trichomoniasis is associated with other infections and is regarded in France, Germany and elsewhere as an important indicator of enhanced risk of reproductive failure. However the literature is not wholly convincing that it is trichomoniasis per se rather than associated infections that does the damage.

Screening for bacteriuria as part of antenatal care is routine in Finland and Sweden, is a part of recommended good practice in France, and in Britain is recommended in the *Memorandum on Maternal Care by General Practitioners*. There have been large numbers of studies of bacteriuria in pregnancy suggesting that while infection of the urinary tract does not interfere with pregnancy directly, bacteriuria is a useful preliminary indicator of pyelonephritis which does interfere seriously (19). There is also evidence that women with bacteriuria may also be more likely than women without to suffer from genital infection. The treatment of bacteriuria with antibiotics leading to a reduced prevalence of preterm birth seems in many cases to be explained by the fact that the antibiotics have also cleared up genital infections.

ANTENATAL RECORDS ESSENTIAL FOR PREVENTION

The report from the Midlands already mentioned refers to the inadequacy of the obstetric records received from the primary antenatal care level by the hospitals. The minimum information on blood pressure, urine analysis and oedema necessary for a diagnosis of toxaemia was only received in 32 per cent of cases. In only 33 per cent of cases was a medical history provided although it was asked for on the booking form. The inadequacy of records passing from primary care level to hospitals not only prejudices the treatment of patients but wastes substantial sums of money in the duplication of tests, for example of blood tests which were recorded by primary care level in only 44 per cent of cases (12).

This is, of course, a management matter for the National Health Service. The English *Memorandum on Maternal Care by General Practitioners* says nothing about the importance of continuity of medical records.

An antenatal care service that is effective in preventing preterm birth needs a good record system including good communication between primary care level and hospital. Good records are needed by both doctors and midwives at primary care level and by the hospitals for many reasons. An optimum deployment of resources is only possible if the minorities of women are identified who are at greater risk. A recent British paper based on the 1958 Perinatal Mortality Study summarised:

> "It was shown that the risk of spontaneous preterm birth was related to low maternal age, low maternal weight, maternal smoking, low social class, illegitimacy, threatened abortion, and a previous history of antepartum haemorrhage, perinatal loss, or low birthweight live births." (20).

These are the "fixed" factors noted in Chapter Three as contributing to a numerical risk score which is in practice unable to identify at least 40 per cent of the women at risk. We noted that by adding the "variable" factors found at each antenatal examination better prediction is possible. This requires good records.

We have noted that delaying drugs are dangerous for some women. The record for this and other reasons needs also to contain some medical non-obstetric detail. There is much else that may be in a medical history that may make a particular course of action not only undesirable but dangerous for mother or child and may dictate a different course. There are excellent antenatal record systems in use in some countries such as Finland, Sweden and East Germany (21).

CHAPTER FIVE

ANTECEDENTS OF PRETERM BIRTH

SOCIAL, BEHAVIOURAL AND BIOLOGICAL FACTORS

Preterm birth is social class correlated and became more so in Britain between 1958 and 1970. The first report of the British Births Survey 1970 said:

> "There is nothing to contradict and everything to support the theory that social class differences are widening rather than diminishing". (1).

Indeed in social classes I to III the prevalence of preterm birth fell but it increased in social classes IV and V and particularly among women with no husband as seen in Table 5.1

Table 5.1

PRETERM BIRTH AT LESS THAN 37 WEEKS BY SOCIAL CLASS: BRITAIN 1958 and 1970 (1) singletons only

Social Class	British Perinatal Mortality Survey 1958: 15,685 births	British Births Survey 1970: 13,161 births
I and II	4.0	3.6
III	4.8	4.2
IV	4.9	6.5
V	5.5	
No husband	5.9	10.2
Average	5.3	6.4

In the 1958 Survey 4.0 per cent of the perinatal deaths were of babies born to women without husbands; this had increased to 12.8 per cent by 1970.

The social classes as defined by the Registrar General only provide one social indicator. Figure 5.A lists some of the other adverse social factors correlated with preterm birth (2). Adverse social and behavioural factors can, of course, only act on the foetus through adverse biological factors. Either low income or poor nutritional habits may, for example, result in a poor maternal nutritional status. Unhygienic living conditions may result in more maternal infection. It is, in the context of preterm birth, the biological consequences of the social and behavioural factors that matter.

There is a recent history in one country or another of projects to influence every one of the social, behavioural or exogenous biological factors in Figure 5.A with the aim of reducing reproductive casualties. The British Health Education Council has advertised the increased risk that results from smoking during pregnancy.

The French Government has increased women's income during pregnancy with allowances which also provide an incentive for conscientious use of the antenatal care services. The United States Government has introduced food supplements for pregnant women in need. The multifactorial origins of preterm birth and reproductive casualties generally indicate that risks can be reduced within any population by influencing one or more factors.

The total problem of prevention does not only depend upon the efficiency of the antenatal care service. Infections, nutritional deficiencies, poisons, trauma and probably fatigue may have an unfavourable influence from the very beginning of pregnancy. Indeed infections, nutritional deficiencies and trauma during the period preceding a pregnancy are well-established contributors to subsequent pregnancy failure. The problem of prevention involves therefore nothing less than the health of all young women of reproductive age.

OBSTETRIC AND GYNAECOLOGICAL CARE OF WOMEN AND GIRLS

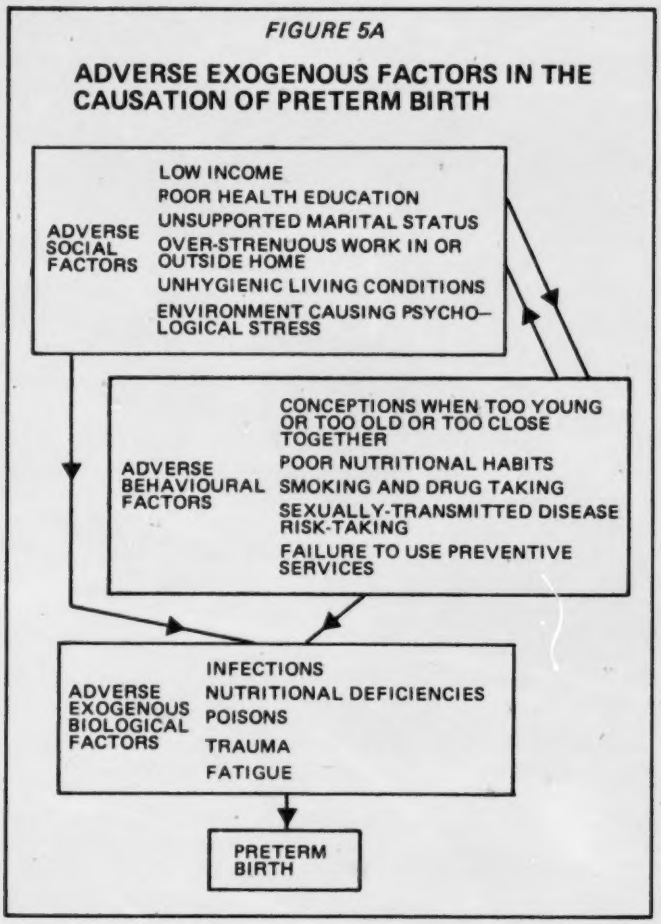
A study of the countries, notably Sweden and Finland, who have the best reproductive health, suggests the desirability of a specialist obstetric and gynaecological service not only in the hospitals but more particularly in the community at primary care level (3). There are, indeed, the strongest arguments for women having a women's service to which they can go with obstetric and gynaecological problems.

Sweden is one country which has Women's Clinics manned by midwives and visited by obstetricians

(4). There is a growing number of community obstetricians who work from the hospitals. In Sweden a woman has the right to visit any nurse or doctor at her local Health Centre or hospital or any other Health Centre or hospital in her Area (County). But a woman with any obstetric or gynaecological problem is encouraged to make first contact with her district-based midwife. This midwife has regular, advertised telephoning hours and hours for consultation.

FIGURE 5A

ADVERSE EXOGENOUS FACTORS IN THE CAUSATION OF PRETERM BIRTH



In more thinly populated rural districts there are no midwives and maybe no nearby hospital with an obstetric department. There is then a district nurse who works to a general practitioner generally at a Health Centre but he may be by himself in very remote districts. In towns and cities the midwives work to obstetricians, increasingly the community obstetrician. The community midwife is trained as a midwife but also has a wider training appropriate to primary care nursing which is not confined to antenatal care and includes for example, family planning and cytotesting.

In practice in Sweden a midwife's first contact with a young woman is generally when she first seeks contraceptive advice. The community midwife is the normal source of such advice and of contraceptives available at a low price or free (5). It is this particular family planning role that is responsible for a good coverage of women by the Women's Clinics, and results in the women getting to know the midwives who are looked upon as women's first friends in all their obstetric and gynaecological problems. A woman may make direct contact with an obstetrician if she wishes, but in practice generally sees the midwife.

The Women's Clinics are concerned to make contact with young women as soon as possible after leaving school. The period between leaving school and a first pregnancy are "the unprotected years". The highest prevalence of sexually transmitted disease in every country with published records is found among very young single women roughly in the 18 to 20 age bracket. It is an important role of Women's Clinics not only to refer young women but to teach them to refer themselves for medical attention if there is the least evidence of infection such as an unusual vaginal discharge.

Cytotesting is also a responsibility of Women's Clinics and in Sweden begins already in adolescence. Occasional cases of dysplasia are found among women not yet 20 and some of the worst cases are now

found among women under 30. Cytotesting of very young women also, however, results in the diagnosis of cases of infection that might not otherwise be discovered. Whatever the ravages of infection at other ages it is, of course, the infection of these very young women that can, if neglected, seriously prejudice subsequently childbearing.

A treatise on prenatal pathology by the professor of child health of the University of Vienna, also President of the European Congress of Perinatal Medicine in 1978, said:

> "We consider that unidentified infections are a very important part of the hidden causes of prenatal illness which are recorded simply as preterm birth." (6)

The infections which do the damage may be contracted before the beginning of pregnancy and may do their damage before antenatal care begins. (7) The referral of women suspected as suffering from an infection for medical examination, and treatment if necessary, is a major role of Women's Clinics. The types of infection reported in the literature to be associated with preterm birth include the sexually transmitted diseases: trichomoniasis, chlamydia, gonorrhoea, hepatitis virus, herpes genitalis and syphilis.

The number of new women patients seen at English hospital clinics for sexually transmitted disease reached 143,490 in 1975 (8) Sixteen years previously in 1959 the corresponding figure was 29,360. This amounts to an average rate of increase per year of 10 per cent. Even allowing for some improved diagnosis and an increase per year of only 6 per cent between 1971 and 1975, sexually transmitted disease remains a serious and growing problem. It has therefore never been more important for there to be good Women's Clinics. British specialist clinics for sexually transmitted disease are among the best in the world. The problem is to bring the treatment to the women in need of it and enable venereologists to make a larger contribution to the protection of child-bearing.

Sexually transmitted diseases are of particular concern because of the rising prevalence in recent years, but many other diseases affect the course of pregnancy. A German review paper on infection in pregnancy points out that the more thorough the antenatal search for infection, the more is found, and added:

> "The application of serological and bacteriological techniques for the diagnosis of prenatal infections has so far been restricted. So far the availability and the cost of individual methods has only permitted their use in some cases when there were special reasons for being suspicious. Many opportunities for treating prenatal disease have in this way been missed." (9)

There is a formidable literature supporting this view, but it is probably true that most of the women acquire these prenatal infections before they become pregnant. The battle against these infections by Women's Clinics should not therefore be limited to the antenatal period.

Nutrition is now established as one major factor influencing immune response and resistance to disease (10) Badly fed women suffer more from the ravages of infection. The North-American nutritional surveys show that, although there are extraordinarily wide variations in the intakes of particular essential nutrients in all social classes, the intake of many of these nutrients is lower on the average in the poorer social classes (11) It might be expected therefore that badly fed women because of their poorer resistance to infection would have more preterm babies. Table 5.2 shows the association of preterm birth and poor weight gain from a study by the Children's Hospital, Buffalo; weight gain is correlated with nutritional intake (12). It is seen that very substantial increases in weight gain in pregnancy only provide a limited degree of protection against preterm birth, but some protection nevertheless. Maternal weight before pregnancy also provides a crude indication of nutritional status. The light women also have more preterm births; this has been shown in a recent British paper based on the 1958 Perinatal Mortality Survey data (13).

There is indeed a minority of thin women who have poor weight gains and have about twice the average prevalence of preterm birth. This is one risk group of women not difficult to identify. It is not established how poor nutrition increases the prevalence of preterm birth but it is one reasonable hypothesis that it does so by reducing defences against infection. This is only one of the effects of poor nutrition on the course of pregnancy.

There are now studies from many countries showing an association between poor nutrition of the mother, poor weight gain and foetal growth retardation, which is another large subject outside the scope of the present study. (14)

The course of pregnancy may be prejudiced by viruses, rickettsiae, bacteria and protozoa. The badly fed woman has less resistance to almost all such diseases. Diet in pregnancy is therefore not only concerned with the body-building requirements of mother and baby, but with ensuring good resistance to invasion and colonisation by a wide range of microorganisms. Good nutrition is perhaps particularly important for improving defences against the viral diseases which are not susceptible to any existing antibiotic.

Table 5.2

WEIGHT GAIN DURING PREGNANCY BY PERCENTAGE OF BABIES BORN AT LESS THAN 37 WEEKS' GESTATION: U.S.A. (12)

10,000 live births: negro & white

Weight gain during pregnancy Pounds	Percentage of babies born at less than 37 weeks' gestation
0—15	18.3
16—25	12.2
26—35	9.9
36+	9.8

Every woman has her own individual problems. It has been shown for example that nutritional habits are very individual and are difficult to change. However many women have no nutritional problem but need a play-group or nursery place for a toddler to enable them to rest on medical advice.
The support of a Woman's Clinic needs to be personal, taking into account the age, knowledge, experience and education of the woman. Staffing must be adequate for time to be spent in discussion of a woman's particular needs.

The Swedish health service, controlled as it is by elected representatives at a level equivalent to the British Area, is much more democratic than the British patriarchal health service, lacking any level of elected representation below that of Members of Parliament. (15) The Swedish health service reflects the wishes of patients and the public in its organisation and procedures more obviously than the British national health service. Swedish women wanted Women's Clinics providing a specialist service for obstetric and gynaecological problems and gradually over the years such a service developed, although it is still incomplete in some parts of Sweden and is still extending. Is it really possible that such Women's Clinics would not also serve British women well? Britain has had its family planning clinics, well-women's clinics, cytological testing clinics, antenatal clinics, which may be regarded as Women's Clinics in embryo. They are not, however, the same thing as Women's Clinics covering all obstetric and gynaecological problems which really only exist in Britain in important hospitals. Some of the British services, such as cervical cytology testing have a poor coverage. Would not Women's Clinics at primary care level do better in ensuring earlier reporting for antenatal care? And what do informed British women think?

PREVENTION OF PRETERM BIRTH FOLLOWING TRAUMA FROM INDUCED ABORTION

There are now numerous papers from many countries showing an increased prevalence of preterm birth following induced abortion (16). How far can these unfortunate consequences of induced abortion be prevented? This is a cause of preterm birth which has been the subject in recent years of very careful study showing that much preterm birth from this cause could be prevented.

Table 5.3

PRETERM BIRTH AFTER PREVIOUS INDUCED ABORTION: ENGLAND 1976 (17)

	After previous induced abortion		After previous spontaneous abortion	
	No.	per cent	No.	per cent
1st trimester abortion	9	4.3	2	1.4
2nd trimester abortion	18	8.5	2	1.4
Premature delivery	29	13.7	7*	4.7
Delivery at full term	155	73.5	136	92.5
	211	100.0	147	100.0

*Includes one patient induced at 28 weeks because of foetal abnormalities.

From the papers showing an enhanced prevalence of preterm birth following induced abortion we have selected two from teaching hospitals, one from Bristol, England, and one from Warsaw, Poland, showing similar and not untypical results (17) (18). A note gives some further selected references to other papers showing enhanced preterm birth prevalences in subsequent pregnancies following induced abortion (16).

Table 5.4

PRETERM BIRTH AFTER PREVIOUS INDUCED ABORTION: POLAND 1973 (18)

Weeks of gestation completed before preterm birth	After previous induced abortion		No previous induced abortion	
	No.	%	No.	%
17 - 28	20	2.6	4	0.4
29 - 36	73	9.6	53	5.2
37 - 38	150	19.7	172	17.0
39 - 40	364	47.8	543	53.5
41 - 43	155	20.3	243	23.9
	762	100,0	1015	100.0

Tables 5.3 and 5.4 suggest that if the obstetric history of women with cervical incompetence is studied, an over-representation of women with a history of induced abortion should be found. This expectation is confirmed in Table 5.5 using data from the University Teaching Hospital of Debrecen (19). In the population served by this medical centre there was a rather high abortion rate of about 30 induced abortions for every 100 live births, or about double the current British rate.

In some hospitals in Scandinavia, Germany and Eastern Europe induced abortions and subsequent deliveries have all been done in the same hospital so that very detailed records have been available. There have for example been operation notes available showing the diameter of the dilator used in the abortion operation, and it has been possible to relate these to subsequent cervical incompetence. It has been found that the amount of cervical incompetence increases as the dilator diameter increases beyond 8 mm. There are now major hospitals, for example in Sweden, which never use a dilator for an induced abortion more than 8 mm in diameter. There are British papers published in medical journals describing and even recommending abortion techniques using mechanical dilatation to not only 10 mm but to 12 mm, 14 mm, 16 mm and even 18 mm. There are British and American papers which agree with the European view that cervical incompetence is caused primarily by dilatation to 10 mm or more (20). This is another area where there is a manifest need for a code of good practice, although it is difficult to see how the size of dilators used in private clinics could be controlled.

Even in countries like East Germany that appear from their published papers to know how to do abortions without causing cervical incompetence, there was nevertheless a substantial increase in the prevalence of cervical incompetence in 1973 and 1974 following liberalisation of abortion in 1972, and a steep increase in the number of cerclage operations. It is not clear how far this cervical incompetence was the result of inexperienced or clumsy operation resulting in laceration of the cervix, to using dilators in excess of 8 mm or to cervical incompetence still caused by dilators only 8 mm in diameter or less. Even when induced abortion is done under apparently good control in large hospitals it still seems to produce some cervical incompetence.

Not all cervical incompetence found in practice is the result of a previous induced abortion. There are many series reported showing cervical incompetence following what was regarded as a routine dilatation and curettage operation (21).

It is possible to establish the prevalence of cervical incompetence by the examination of the cervix in any population of women. As such an examination is desirable for women at 16 weeks' gestation it is easiest to determine the prevalence in pregnant women (22). This is necessary knowledge for monitoring the competence with which abortion operations are being done and for the protection of the women concerned, particularly when it is shown that induced abortion performed in some clinics is resulting in cervical incompetence, and excessive dilatations stated to be a cause of cervical incompetence in other published papers are being advocated by other surgeons in yet further published papers.

We noted in Chapter Four that it is possible to prevent preterm birth in spite of cervical incompetence by good antenatal care in a subsequent pregnancy, which requires a thorough cervical examination at 16 weeks and subsequent treatment with a cerclage operation and possibly delaying drugs.

There are thus two points in time at which preterm birth in a pregnancy following induced abortion may be prevented: good practice in the abortion operation itself can prevent much cervical incompet-

ence; good practice in subsequent antenatal care can prevent preterm birth in a subsequent pregnancy in the majority of cases. We stressed in the last chapter that the full cooperation of the woman concerned is essential. Those women who may wish to bear a child subsequently should be expressly counselled at the time of the abortion about the need to report early for antenatal care in a subsequent pregnancy. The sequence of events which can lead to a successful pregnancy even when there has been cervical damage is shown diagrammatically in Figure 5B entitled: "Preventing the consequences of cervical damage in subsequent pregnancy following induced abortion." The events leading to failure are also shown.

Table 5.5

HISTORY OF INDUCED ABORTION BY BIRTH OUTCOME IN SUBSEQUENT PREGNANCY WITH AND WITHOUT CERCLAGE: HUNGARY 1971 (19)

N	Women who had no cerclage operation and a late spontaneous abortion or preterm birth	Women who carried babies to term following a cerclage operation for cervical incompetence	Control sample of women who had normal pregnancies matched for age
With known history of induced abortion	546	546	1092
	per cent	per cent	per cent
	90.1	80.0	32.2

PREVENTION OF REPRODUCTIVE FAILURE ASSOCIATED WITH INFECTION FOLLOWING AN INDUCED ABORTION

Cervical trauma is not the only cause of preterm birth following induced abortion. It is seen in Table 5.3 that there was a higher rate of first trimester abortion in the series that had had previous induced abortions. This same apparent increase in first trimester abortions is also shown in other series. This is not the result of cervical incompetence. It has been shown in a number of studies that the population of women who have abortions also has a higher prevalence of infection with sexually transmitted disease. (23). These women would therefore be expected to have higher rates of first trimester spontaneous abortion. The abortion operation can aggravate infection by carrying it from the vagina or cervix into the uterus but is not in most cases the cause of the infection(24). There are many reports of women being acutely ill with infection of the uterus, tubes or ovaries following an induced abortion. A writer in a British journal reported:

> "In one week I have had to treat three women whose pregnancies had been terminated in the same nursing home on the same day; all three had bacterial endometritis and salpingitis." (25)

A higher prevalence of sterility and ectopic pregnancy following induced abortion has been reported and is generally attributed to inadequate infection control due to deficient after-care (26). The events leading to a normal birth in a subsequent pregnancy or to the ravages of pelvic infection are shown diagrammatically in Figure 5C. Such sequelae of induced abortion are largely preventible by good after-care and prompt treatment if there are any signs of infection. An abortion operation should indeed always be considered as an opportunity to control infection among a population of women with a higher than average level. Some countries, for example Czechoslovakia, have legislation making tests for infection compulsory before an operation for abortion.

Some infection appears only weeks or months after an operation so that the right after-care procedures are not so easy to organise and merit systematic study (27). The cooperation of the women concerned is essential to success (28).

Public discussion of legal abortion all too often places inadequate emphasis on the health and welfare of the unfortunate women who have abortions. The quality of the service provided has varied in Britain from very good to very bad. Quite apart from the cost to the community both of subsequent reproductive casualties and of the women's subsequent ill-health, a bad service all too often adds misery to misery for the women themselves.

FATIGUE AS A CAUSE OF PRETERM BIRTH

There have been many studies of the effect of women's work on the outcome of pregnancy but the results have been difficult to interpret. Recent papers show that among social factors income, education and marital status are much more important than whether a woman works or not (29). Of course if a woman does not work the family income is generally lower and this may offset the effect of more rest. There are old papers showing Finnish country women working on farms in 1940-45 having less

than 3 per cent of low birthweight babies while women at the University Women's Clinic in Helsinki had over 10 per cent (30). There is a Danish study showing working country women having only 3.2 per cent of low birthweight babies, while the women in a neighbouring city had 8.0 per cent (31). There is a study of peasant women working in the mountains of the Austrian Tyrol showing only 3.5 per cent of babies under 2,500g (32). The writers have seen recent records of a rural population in Sweden also showing only 3 per cent.

FIGURE 5B

PREVENTING THE CONSEQUENCES OF CERVICAL DAMAGE IN SUBSEQUENT PREGNANCY FOLLOWING INDUCED ABORTION

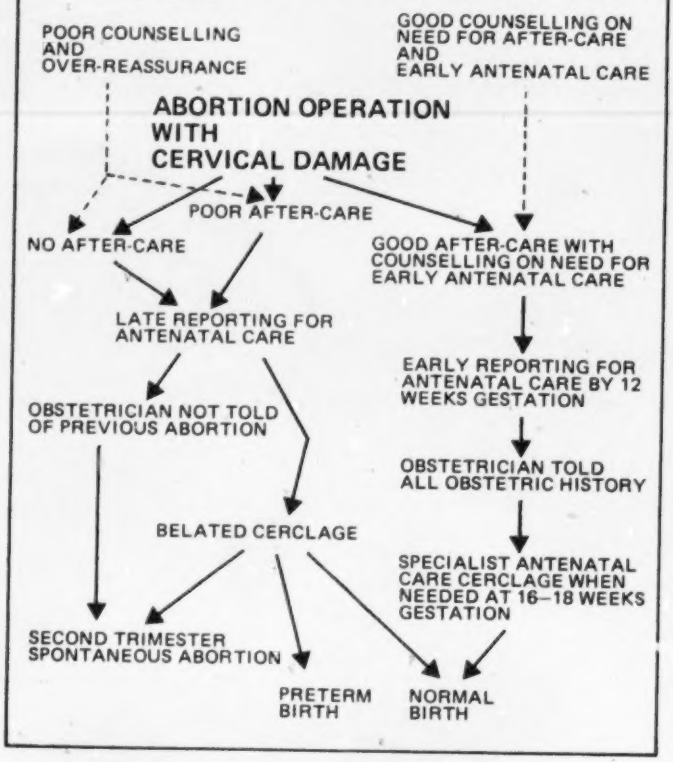
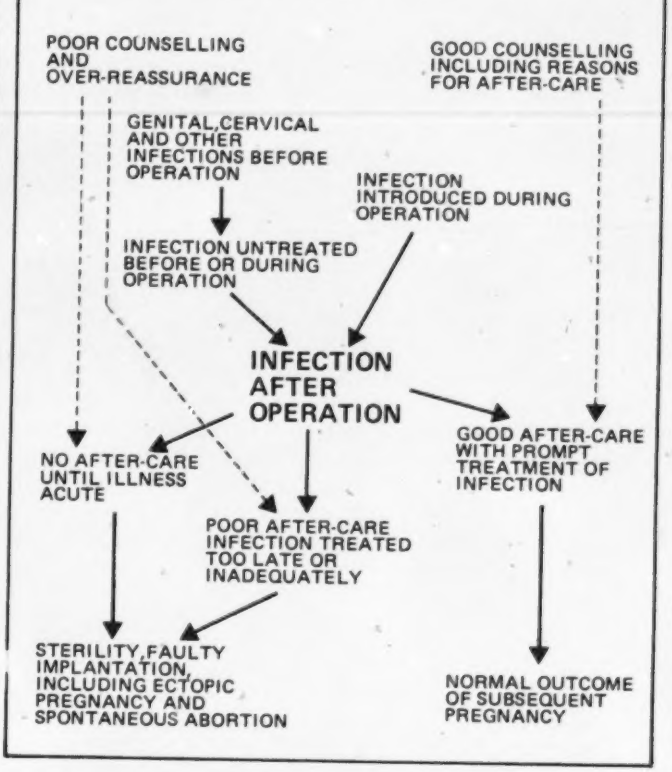

POOR COUNSELLING AND OVER-REASSURANCE
GOOD COUNSELLING ON NEED FOR AFTER-CARE AND EARLY ANTENATAL CARE
ABORTION OPERATION WITH CERVICAL DAMAGE
POOR AFTER-CARE
NO AFTER-CARE
GOOD AFTER-CARE WITH COUNSELLING ON NEED FOR EARLY ANTENATAL CARE
LATE REPORTING FOR ANTENATAL CARE
EARLY REPORTING FOR ANTENATAL CARE BY 12 WEEKS GESTATION
OBSTETRICIAN NOT TOLD OF PREVIOUS ABORTION
OBSTETRICIAN TOLD ALL OBSTETRIC HISTORY
BELATED CERCLAGE
SPECIALIST ANTENATAL CARE CERCLAGE WHEN NEEDED AT 16–18 WEEKS GESTATION
SECOND TRIMESTER SPONTANEOUS ABORTION
PRETERM BIRTH
NORMAL BIRTH

FIGURE 5C

PREVENTING THE CONSEQUENCES OF INFECTIVE COMPLICATIONS FOLLOWING INDUCED ABORTION


POOR COUNSELLING AND OVER-REASSURANCE
GOOD COUNSELLING INCLUDING REASONS FOR AFTER-CARE
GENITAL, CERVICAL AND OTHER INFECTIONS BEFORE OPERATION
INFECTION INTRODUCED DURING OPERATION
INFECTION UNTREATED BEFORE OR DURING OPERATION
INFECTION AFTER OPERATION
NO AFTER-CARE UNTIL ILLNESS ACUTE
GOOD AFTER-CARE WITH PROMPT TREATMENT OF INFECTION
POOR AFTER-CARE INFECTION TREATED TOO LATE OR INADEQUATELY
STERILITY, FAULTY IMPLANTATION, INCLUDING ECTOPIC PREGNANCY AND SPONTANEOUS ABORTION
NORMAL OUTCOME OF SUBSEQUENT PREGNANCY

Studies of urban populations have shown higher prevalence of low birthweight among women doing manual labour (33). It has been suggested, however, that this is a social class correlation as only women in the poorest social class did manual work outside the home and a proportion of these were badly fed. (32). Certainly the rural populations, with 3 per cent only of low birthweight babies have a very different life style, environment and diet from poor urban populations. There is also less infection in these particular rural populations.

Much evidence has, however, now accumulated to show that there is a minority of women amounting in some populations to perhaps 5 or 10 per cent for whom extensive rest during the last trimester of pregnancy is indicated (34). This minority is said in some studies to include women carrying twins but this is not supported in other studies (35). The treatment of multiple pregnancies needs however complete revaluation using delaying drugs. It is reported that at least one quarter of women need extra rest for the remainder of the pregnancy following a cerclage operation (36).

It was shown in a Helsinki project over a period of five years (1954 to 1958) that reduced work and three or four hours' bed-rest during the day could reduce both the prevalence of low birthweight and perinatal mortality even if restricted to quite a small minority of women thought to be at risk of having preterm or low birthweight babies (34). In this experiment the Helsinki local authorities made up the wages lost by the women selected as needing the extra three to four hours' bed-rest during the day. Seven thousand women participated and perinatal mortality was reduced from 26 to 13 per 1000, a reduction mainly attributable to a similar reduction in the prevalence of low birthweight or preterm birth.

Similar experiments have been reported more recently from the Soviet Union. The women in the second trimester of pregnancy thought to be at risk of producing preterm or low birthweight babies, are persuaded to move to a convalescent home, called in Scandinavia a "patient hotel" where they have ample bed-rest, regular meals and a regular ante-natal examination (37). Younger children go with their mothers to the patient hotel, while arrangements are made for older children to be looked after at home. It is claimed that the prevalence of low birthweight under 2500g has been reduced from over 8.0 to 4.0 per cent by these means. It is unclear from these reports whether the great improvement in low birthweight prevalence was the result of more rest, of meals under the supervision of a dietician or of better antenatal care. It is apparent from some Russian papers that antenatal care improved during the same period, including not only infection control but systematic screening and treatment of heart conditions which are believed to be associated with low birthweight. The Soviet experience is evidence that the better care of women during the second and third trimesters of pregnancy can fairly quickly reduce the prevalence of low birthweight to 4 per cent, without, however, providing much indication as to what aspects of better care are most important in producing the good results.

It has been shown in Canada that there is a few per cent of pregnant women who reject antenatal care and have difficult psychological and familial problems (14). Transfer to an attractive patient hotel, together with any young children, is an essential remedy for this rather small minority of cases.

There is, indeed, in every country a minority of women who are not so ill that they need to be in hospital, but whose pregnancy is too much at risk for them to be at home. In a patient hotel with rest and good food antenatal care can be optimised and there is a resident midwife there all the time to act in an emergency. In such a patient hotel it is possible to act very quickly at any time to stop a preterm birth. It is possible for particular women to wear portable tocographs if necessary. Educational and leisure occupations can be combined with health care during the weeks spent in such a patient hotel. The reproductive failure of these women at high risk can be enormously costly to the community if it results in a child being born with life-long handicap. The cost of temporary residence in a patient hotel is a very small fraction of the cost of the average case of cerebral palsy.

In continental Europe from the Atlantic to the Black Sea, there are innumerable establishments built over a long period for providing cures, convalescent care or various kinds of therapy. They fulfill a role intermediate between that of the hospital and the outpatient clinic. This industry is most developed in the German-speaking world. In West Germany over 1.6 million patients spend a period in these "patient hotels" every year, in Italy 1.25 million, in France 420 thousand. These patient hotels are highly developed in Eastern Europe including the Soviet Union. In France and Germany a stay in a patient hotel can be prescribed by a doctor and can be paid for by the health insurance carrier, although a contribution from the patient is usually required (38). West Germany has 150 homes or patient hotels which only take mothers for rest or convalescence, which have taken 1.75 million mothers in recent years. Existing children are looked after in children's homes or holiday camps while the mother is in the patient hotel, or in some districts by specially trained home helps (39). The thought of sending pregnant women in need of rest and some obstetric supervision to such patient hotels seems to fit naturally into existing patterns of health care in many continental countries. The application in practice of the new techniques for preventing preterm birth requires the option to prescribe residence in a patient hotel to be available to the obstetrician. The option to provide rest at home on sick pay for some women is also essential but studies of case histories suggest that this is not enough for other women, who need a quiet and enjoyable rest away from the domestic scene. It is not, indeed, rational for there to be only two options, either ambulatory out-patient care or hospitalisation. A British consultant obstetrician commented to the writers:

> "I often suggest to our colleagues how much better off some of our long stay antenatal patients and the majority of the lying-in mothers and babes would be if instead of remaining in the obstetric hospital at a cost of approximately £80 per bed per day they transferred to the nearby luxurious Trust House Forte hotel for I suppose £30 a day."

In any operational research project aimed at determining the organisational arrangements necessary to enable action to be taken in time to prevent preterm birth, residence in a patient hotel should be one of the options. The establishment of at least one such patient hotel would be necessary to provide the basic data on what could be done and how much it would cost to prevent a preterm birth. The foreign experience leaves little doubt that if correctly used such patient hotels are one effective administrative means of reducing reproductive casualties and that there is a minority of women where the alternative to providing such an enjoyable holiday will prove to be failure.

CHAPTER SIX

THE CASE FOR AN INQUIRY INTO ANTENATAL CARE AND MATTERS FOR THE AGENDA

In 1976 there were still over 37,000 babies born preterm before 37 weeks' gestation in England and Wales alone. These babies born before 37 weeks include most of those who die in the perinatal period. There has been little change in the prevalence of preterm birth in Britain or in many other countries for a number of years. The new techniques for preventing preterm birth have not yet been at all widely applied in practice and have not indeed yet been fully evaluated.

The new techniques can only be applied if antenatal care services diagnose the women at risk in time. This places a new responsibility on antenatal care services which is reason enough for an inquiry, although the prevention of preterm birth is only one purpose of antenatal care.

The greatest potential for reducing perinatal casualties is to be found in improvements in antenatal care (1). Subsequent handicap is the most costly consequence of illness in the perinatal period (2). It has been estimated in Sweden that for every perinatal death prevented a further two to three infants on average are saved from more or less severe damage and from subsequent handicap (3). There were 10,200 perinatal deaths in England and Wales in 1976 and therefore, accepting the Swedish estimate, between 20,000 and 30,000 infants who suffered perinatal damage. A reduction in the perinatal mortality in England and Wales only to the Swedish 1975 level of 11.3 would save 3,400 perinatal deaths and 7,000 to 10,000 cases of perinatal damage each year.

Since 1970 there has been a series of reports on maternity and child welfare including the recent Court Report of the Committee on Child Health Services in 2 volumes and 670 pages, the Lane Report of the Committee on the Working of the Abortion Act in 3 volumes and 667 pages, the Peel Report on Domiciliary Midwifery and Maternity Bed Needs in 135 pages and the Sheldon and Oppe Reports on neonatal care covering a further 49 pages. Antenatal care in contrast has not been the subject of any comparable report. The most up-to-date governmental document covering antenatal care is the *Memorandum on Maternal Care by General Practitioners* 1975 which includes only two and a half pages on antenatal care and belongs to the most humble category of official publications and was not apparently based on any evidence submitted to the Department. A Report based on a full inquiry into the organisation and operation of antenatal care is overdue in Britain and in other countries.

The present limited study points to questions meriting a place on the agenda of such an inquiry. A first step in controlling any form of morbidity is to record and publish good epidemiological data about it, with other data showing social, behavioural and biological correlates. Official information for England and Wales related to perinatal events is very largely missing although data on birthweight and gestation are now being collected in preparation for publication. Indeed epidemiological information relating to the whole of obstetrics and neonatal care is very scarce in England and Wales. Britain has had two important inquiries into perinatal problems, the British Perinatal Mortality Survey 1958 and the British Births Survey 1970, each covering about 17,000 births. Both these Surveys were financed by the National Birthday Trust Fund, a charity dependent upon voluntary contributions. In contrast the U.S. Collaborative Perinatal Study 1959-1965 was financed by the U.S. Federal Government. The French Prospective Study of 18,000 pregnancies 1963-1969 and the French National Study of 11,000 births 1972 were financed by the French Government and conducted by the French Medical Research Council. There are many similar studies in other countries all government-financed. Only in Britain have such studies been left to the inevitably limited resources of a private charity, although it is to the great credit of this British charity that the 1958 Survey was the largest and most thorough that had been undertaken up to that time.

Such limited surveys are being increasingly displaced by more comprehensive national records. Some countries including East Germany, Finland and Sweden have comprehensive records of morbidity found during antenatal care. Britain has no such record. This is an important item for the agenda of an inquiry. Rational planning of antenatal care can only be based upon the morbidity found in practice.

Such antenatal records are also an essential basis of accountability. It has been noted that some women reach the end of pregnancy with untreated infections, lose their babies because of undiagnosed cervical incompetence and reach hospital for delivery without adequate records. These are results only to be expected from arrangements lacking any system of accountability for what is done. The inquiry should address itself to this weakness in the present system. The *Memorandum on Maternal Care by General Practitioners* should be brought up to date. Whether antenatal care is provided by a general practitioner, by a midwife or by a hospital the basic antenatal records should be the same, and should indicate that the right tests and examinations have been done. It is for consideration whether a Maternity Book in the hands of the mother should be a part of the system.

The outcome of pregnancy is, of course, in part the outcome of antenatal care. Systematic records of the outcome of pregnancy are also needed and have now been established in Scotland but not yet in

England and Wales. The Scottish records of length of gestation and birthweights are compiled from the Scottish Maternity Discharge Sheet. Such records are essential for monitoring the results of antenatal care and of delivery. A growing number of countries now have two standard records at the end of pregnancy, one an essentially obstetric record mainly about the mother and another an essentially paediatric record about the newborn baby. The introduction of such a paediatric record was recommended by the Court Committee (4). Such a record is statutory in France and must be signed by a doctor with paediatric qualifications (5).

The expanding output of new knowledge makes it essential in a subject as important as obstetrics to have a good information retrieval system and to spend more money on practical obstetric research much of it aimed at confirming and extending work done abroad in the first place. Britain today undertakes only about 5 per cent of the world's medical research, so that most new developments are inevitably imported from abroad. This must be another matter for the agenda of the inquiry. New foreign developments must generally be re-evaluated in Britain. Thalidomide was a drug developed abroad and introduced into Britain without adequate evaluation by the government of the day. The effects of oxytocin on mother and baby have never been adequately evaluated in Britain and recent British papers are poor contributions to evaluation more particularly because of the inadequate data on which they are based. Delaying drugs are another foreign development meriting careful evaluation before being put into general use in Britain. The alternative to each country undertaking its own evaluation of new drugs or techniques is close international collaboration in staging trials. We noted that four nations, not including Britain, did collaborate in trials of delaying drugs (6). Such international collaboration saves money and often produces a better result because of the scale on which it can be conducted.

The inquiry into antenatal care must attempt to answer the question: What institutions and what administrative arrangements are necessary to ensure that antenatal care keeps up-to-date? The allocation of more funds for research and for the evaluation of new techniques is part of the answer, but it is not the whole answer. There is also a major educational task. There is a need for regular, specialist refresher courses for all personnel engaged in antenatal care services.

If it is considered what has to be learnt, and what a long way there is to go even to apply existing knowledge, it must be asked whether antenatal care must not be increasingly a matter for specialists only. In a large and indeed growing part of the world all obstetric and gynaecological care is undertaken by specialist doctors and midwives. This is the practice in the urban areas of Scandinavia.

In England in 1974 there were still Areas such as Gateshead and Tameside with perinatal mortalities as high as 28 and 29; these bad Areas contrast with the best Areas such as Oxfordshire, Kensington, Chelsea & Westminster with perinatal mortalities between 13 and 14. This spread in perinatal mortality of more than 2 to 1 between different Areas has become comparable in importance to the spread in perinatal mortality between the social classes. There is some evidence that the regional differences in perinatal mortality have increased during the last twenty years. The Rhys-Williams Report 1963 highlighted the regional problem and recommended the deployment of resources to reduce disparities and said:

> "Quite apart from the benefits of any new advances in medical knowledge, many thousands of young lives could be saved annually and a corresponding amount of disability avoided, if all areas and hospitals could bring down their perinatal death rates to the level of the best."

The spread of perinatal mortality between the regions shown by this report based on 1958 data was however substantially *less* than shown by the Court Report based on data collected sixteen years later. The inquiry into antenatal care must examine in particular detail the coverage and the quality of the antenatal care provided in the bad Areas.

The provision of antenatal care exclusively by hospital clinics has increased steadily from 36 per cent of pregnant women in England & Wales in 1966 to 48 per cent in 1972. Women have in effect been voting with their feet in favour of hospital antenatal care even although the number of hospitals providing such care has diminished and travelling distances have in consequence increased. The desirability of this trend must be questioned by the inquiry because the travelling time, travelling cost and hospital waiting time often discourage regular attendance, and because the catchment areas of hospitals contain so many women that routine as distinct from special antenatal care at hospitals results in large impersonal clinics and an absence of the closer personal relations possible for smaller local clinics situated in the community. It is important that women should be able to vote with their feet and obtain their antenatal care from Women's Clinics or Hospital Clinics as they wish.

In a Swedish town a woman would normally report a pregnancy to a community midwife who would belong to the local Women's Clinic. In Finland she would generally report to a midwife who would however be found at the local maternity and child health centre. She would generally know the local

midwife. In Sweden antenatal care is shared between the midwife and an obstetrician from the maternity hospital to which the Women's Clinics belong as satellite outposts within the community. In Britain the relation between midwives and doctors is ill-defined. The Royal College of Midwives has recently said: "Clarification of the role of each member of the maternity services team is essential." (7). This is a difficult problem as long as non-specialist doctors or nurses are members of the team. A midwife working in an obstetric department of a large hospital becomes much more expert at obstetrics than a general practitioner who is treating and advising on a great range of medical problems. It should be one purpose of the inquiry to define the responsibilities of midwives for antenatal care.

In Sweden out of an average of 13.5 antenatal consultations per woman 9.5 are with midwives and 4 with doctors. In Finland with an average of 14.5 antenatal consultations 11.8 are with midwives and 2.7 with doctors. It is to be remembered that these are currently the two countries producing the best results in the world. The success of antenatal care is seen in these countries as depending upon a personal relationship of trust and confidentiality between the midwife and the pregnant woman. Antenatal care is not only concerned with medical screening procedures. A midwife may have to help her patients to stop smoking, to improve their diet, to take enough rest. She may have to help pregnant women with social problems. Women without husbands, for example, who have more than their fair share of preterm and low birthweight babies need much more care in pregnancy than they are now getting. The inquiry must take evidence from women and their organisations on the important human relation problems in antenatal care at the primary care level.

A central question for the inquiry, therefore, must be how to find the extra midwife-hours needed for antenatal care. The present failure in some places to diagnose factors pre-disposing to preterm birth such as infection, cervical incompetence, poor nutritional status, multiple pregnancies and breech presentation early enough in pregnancy will not be overcome without the expenditure of many more midwife-hours in antenatal care. And yet between 1971 and 1975 the community midwifery staff in England was reduced from 5,051 to 3,220 a reduction of over 36 per cent in 4 years. This prompts the question as to whether the available midwife-time is deployed to best advantage between antenatal care, delivery and postnatal care. Both American and French estimates show that there is much more perinatal mortality and handicap to be prevented by improving antenatal care than by improving delivery or postnatal care which are only responsible for about 10 per cent of reproductive casualties and an even smaller percentage, falling below 10 per cent, in the best centres. The French Inspector-General in 1973 following a detailed investigation pointed to the need to increase the numbers of French midwives in order to strengthen antenatal care and in particular to increase the number of home visits to pregnant women (8). The French 7th Plan, beginning in 1976 provided for a substantial increase in numbers of midwives expressly for this purpose of strengthening the antenatal care service in the community (9).

The inquiry must also ask similar questions about doctors with specialised training in obstetrics. Are the talents of such doctors deployed to the best advantage taking fully into account the greater public benefits from improving antenatal care? Are doctors doing work that would be done better and more cheaply by midwives? Are midwives referring the right cases needing the skills of the obstetricians? Are referrals by general practitioners to obstetricians made on the right indications and at the right time? In 1973 in England there were over 200,000 pregnancies where hospitals had no responsibility for the antenatal care of the women they delivered. Is it not undesirable both for these mothers and for the obstetric teams in these hospitals for there to be this divorce between antenatal care and delivery? The ability of these obstetric teams to achieve major improvements in reproductive health is thereby severely limited. How far does this result in a wrong deployment of obstetric talent between antenatal care, delivery and postnatal care? Should not the obstetric departments have more direct responsibility for antenatal care? It is for consideration by the inquiry whether this should include responsibility for staffing local Women's Clinics which have proved so effective in Sweden. Should not the obstetric departments have the resources to operate a monitoring system to investigate failures at primary care level to diagnose the many kinds of antenatal risk cases in good time and any failure to refer such cases?

The primary care service has an important role in teaching and persuading women to look after their own health. Obstetric health does not depend only upon care during the antenatal period. The committee of inquiry will quickly find that the need for both antenatal and interconceptual care is affected by the health of women. The terms of reference of the inquiry must be wide enough to include the health of women insofar as it affects reproductive performance. The purview of Women's Clinics and their midwives should include contraceptive advice, cytotesting, infection control and other gynaecological problems.

Obstetrics has had a rather lowly place in the thinking of successive British Governments in recent years in comparison with the governments of some other countries. This view of obstetrics has continued up to very recent times. The British Government in its paper *Priorities for Health and Personal Social Services in England* (1976) concluded that the maternity services were the outstanding case of a service that was being too generously treated. They had "attracted too large a share of resources". Cutting expenditure

on the maternity services could have expensive consequences to families and to the country in quite a short time.

This inferior status given to obstetrics in Britain has been in part a consequence of the underprivileged status of British women over a long period. Was the Government wrong in thinking in 1976 that it could cut expenditure on maternity services without too much protest from women's organisations? What representations had been made to the Government by women's organisations about the *Memorandum on Maternal Care by General Practitioners* published in 1975? What representations had been made to the Government by women's organisations about the implementation of the Peel Report on *Domiciliary Midwifery and Maternity Bed Needs* published in 1970? The concern of the women's lobby in the quality and coverage of obstetric and gynaecological services has been much less apparent in Britain than in some other countries such as Finland, France or Sweden.

The weakness of the women's lobby in Britain in its attitude to obstetrics and gynaecology is also to be seen in the lack of consensus of women's organisations about the kind of services that they want or their purpose. The writers were told in Sweden that the first demand of Swedish mothers today is to go home from the maternity hospital with an undamaged baby. The same view has been expressed in Britain by a Professor of Obstetrics:

> "In our society, freedom from mental retardation is the demand of the mother for her offspring that outweighs all questions of painless labour, doctor's time, or duration of labour. Parents who devotedly care for disabled children would have endured much to have escaped their continuing burden." (10).

Few things are more damaging to a woman's personal life than damage to her child in the perinatal period. What view, however, have women's organisations taken of 40,000 or more babies born preterm each year in the British Isles or about 50,000 or more babies born of low birthweight? The birth of these frail babies causes enormous worry and concern to the women who have them. The inquiry into antenatal care services in Britain will give all women's organisations an opportunity to contribute to improving health services for women.

France has women's organisations but, unlike Britain, also has a strong family movement. The French Government has a "Family Policy" which expressly includes maternity and child welfare. The French Sixth Plan ending in 1975 and Seventh Plan ending in 1980 both included perinatal programmes primarily concerned with the prevention of handicap of perinatal origin. The French Government announced a new series of measures in amplification of French Family Policy in December 1975, which included new provisions relating to maternity and families with young children (11). The Family Policy adopted by the French Government from time to time follows detailed negotiations with the French family organisations which are, for example, directly represented on the commissions concerned with the French Plans, such as the commissions on the handicapped and on health (12). The British Government has hitherto had no explicit "Family Policy" and there is nothing in Britain resembling the almost continuous negotiations between government and family organisations that take place in France. The inquiry into antenatal care services in Britain must nevertheless seek to obtain the views of families.

A Swedish Government report in 1935 said:

> "The proportion of children now born who are lost should be reduced. This calls for the improvement and extension of medical care of mothers and infants, improving living conditions, hygiene, and nutrition . . . There is indeed, no reason to tolerate any other rate of child mortality in any social group than that which is average in, say, the economically best situated fourth of the population. What that class can buy in the way of child health and child life, the community can buy for other groups." (13).

During the 40 odd years since 1935 the social class differentials in perinatal and infant mortality in Sweden have been eliminated. The main concern in Sweden in the 1930s was to reduce infant mortality although Scandinavian studies in the 1920s had already shown the associations of low birthweight with mental subnormality and other neurological disorders. In the 1940s in Sweden follow-up studies were made of babies born as long ago as 1904, which included adults up to 45 years of age. A book published from the paediatric department of the Karolinska Hospital in Stockholm in 1953 was based on a study of initially 1023 babies of low birthweight and 1023 controls (14). This book showed that there was four times the percentage of persons who had been born of low birthweight in various types of institutions for the mentally subnormal, cripples and blind compared with the control population matched for social class. It is of interest, however, that more of the controls were convicted of criminal offences, other than drunkenness where scores were equal. There were five times as many persons born of low birthweight who had been granted pensions for some form of physical or mental disability,

compared with the control population. 29.6 per cent of the low birthweight babies eventually died, nearly all before reaching adulthood, compared with 15.7 per cent of 981 controls. Nevertheless of those who remained 17.1 per cent were classified as unfit for military service compared with 12.5 per cent of controls. More of the former low birthweight babies were found as adults to be in the lowest income range and fewer in the highest range compared with controls who by that time had however more members of poorer social origin because of the death rate of the former low birthweight babies, particularly those of poorer social origin.

This particular book made a big impression in Scandinavia and it became widely accepted that the care given to pregnant women influenced the quality of a people. Infant-mortality and even serious handicap were only the tips of icebergs. The low birthweight babies also went on needing more hospital care for years and on the average never grew as large as the controls, and never earned as much on the average. Low birthweight manifestly had expensive consequences. It is now known that all these consequences of low birthweight can be mitigated in the majority of cases by high standards of child care, but in no community is every such child assured of such high standards of care.

Speaking as the president of 5th European Congress of Perinatal Medicine in 1976, a Swedish professor could still say:

> "In spite of major improvements due to dedicated health personnel and far-sighted administrators, perinatal medicine still is a neglected area of medicine although important in saving life and minimizing human suffering. Economically, it is a tremendously expensive neglect . . . When reviewing and discussing perinatal mortality it appears merely statistics, but when the actual numbers are realized the size of the problem becomes overwhelming. Perinatal improvement then becomes of prime national importance. This burden is not one which the family should bear alone, but it also becomes the concern of health personnel and politicians." (15).

According to Scandinavian studies, deficiencies in antenatal care, evidenced by preterm birth and low birthweight, are responsible for costs reaching far into the future. A part of the costs incurred currently for hospital treatment, institutional care, supplementary benefit, disability pensions, unemployment pay and loss of earning capacity are attributable to deficiencies in the care of mothers during pregnancy 30, 40 and 50 years ago. These higher costs of preterm and low birthweight babies begin at birth with the expenditure on intensive and special care baby units but often continue for a long time.

Alfred Marshall, in discussing the habit of mind necessary to promote education as a national economic investment, wrote over 80 years ago:

> "It requires the habit of distinctly realizing the future, of regarding a distant event as of nearly the same importance as if it were close at hand (discounting the future at a low rate of interest); this habit is at once a chief product and a chief cause of civilization." (16)

The investment of money in many kinds of education is accepted today as essential to provide the people who can manage and operate the modern industries and services of a developed country. An investment in people, and particularly young people, is a characteristic feature of our industrial society. Indeed the comparative performance of different nations depends as much upon the flow of new talent educated and trained for the right purposes as upon any other factors. However, the measure has not yet been taken of the extent to which human developmental potential can be damaged and limited not only in early childhood but in the perinatal period. A child's genetic potential for development may be frustrated in utero or at birth. It is a purpose of perinatal medicine to attempt to equalize the chances of children of realizing their genetic potential at least up to the end of the first week of life. In order to do this the investment in people needs to begin before they are born by ensuring adequate standards of care for pregnant women.

Preterm birth is symbolic. The percentages of babies born preterm provide one indicator of maternal health. Such percentages provide therefore also an indicator of the adequacy of the investment in health services for women and girls and in particular in antenatal care services. Good maternity and child welfare services are essential to civilization that depends, in the words of Alfred Marshall, upon the habit of distinctly realizing the future and upon investing accordingly.

PREFACE NOTES

1 Court Report (1976) 6
2 French Government papers show 1.92 infants surviving handicapped for at least 12 months for every perinatal death: See France (1970) tableau No. 2. Swedish papers refer to 2 to 3 handicapped survivors for every perinatal death: See Rooth, G. 1976. Numbers of handicapped depend upon definitions.
3 Court Report (1976) 47
4 Cavanagh, D. & Talisman, M.R. (1969)
5 Bayer, H. *et al* (1976)
6 The figures for Scotland include only the 53,398 births for which length of gestation was recorded on the Maternity Discharge Record. Such data are not yet available for England and Wales.

CHAPTER ONE NOTES

1 Allmän hälso- och sjukvård (1973) 93
2 Chamberlain, R. *et al* (1975) 49
3 Scottish Home and Health Department (1974)
4 Butler, N.R. & Alberman, E.D. (1969) 51
5 Canada (1975) 83
6 U.S. National Center for Health Statistics (1972) 79
7 Note 6, *op cit* 31 32
8 Hytten, F.E. & Leitch, I. (1971) 323 to 326. Most of the distributions from developing countries have too few births and deaths in the higher birthweight brackets for statistically significant conclusions about maximum desirable birthweight. Almost every distribution shows however a rise in weight-specific mortality below 3000 g.
9 Cunningham, G.C. *et al* (1976)
10 Puffer, R.R. & Serrano, C.V. (1973)
11 Little, W.J. (1862)
12 U.S. Department of Health, Education and Welfare (1972)
13 Pasamanick, B. (1975)
14 See Lynch, M.A. (1975); Oliver, J.E. *et al* (1974); Smith, S.M. & Hanson, R. (1974)
15 Davie, R. *et al* (1972) 174
16 Both Registrars of Births and Deaths and Area Medical Officers receive particulars of all births and since April 1974 these have included "birthweight" and "period of gestation", see NHS Reorganisation Circular HRC(74)3. It is intended that these data should be collated and published but this has not been done at time of writing.
17 Court Report (1976) 370 para 11 and see 124 para 8. 39
18 Chamberlain, R. *et al* (1975) 85 Table 3.3
19 Perinatal mortality by social class and perinatal mortality of illegitimate babies is discussed in a paper from the Office of Population Censuses and Surveys: Lambert, P. (1976)

CHAPTER TWO NOTES

1 Hüter, J. *et al* (1974). The drugs concerned are classified in Index Medicus as *adrenergic beta receptor agonists*. The drugs are also called *beta-2-mimetic* drugs and *beta-2-adrenergo-mimetic* drugs and also *tocolytic* drugs. The six professors' departments were currently using only: partusisten, also called fenoterol or TH 1165a, manufactured by a German firm Boehringer-Ingelheim; and prepar. also called ritodrine or du 21220, manufactured by a Dutch firm Duphar.
2 Mosler, K.H. *et al* (1974)
3 Allen & Hanbury and Glaxo Laboratories market ventolin also called salbutamol BP. The letter to the authors dated 12th April 1977 from the Committee on Safety of Medicines said:
"Product licences have been granted for 2 beta adrenergic beta receptor agonists on the advice of the Committee on Safety of Medicines who were satisfied in respect to the quality, safety and efficacy of the products for the following indications:
a. Ritodrine hydrochloride (Yutopar) marketed by Duphar Laboratories for use as a uterine relaxant, in the management of uncomplicated premature labour and foetal asphyxia in labour where it is desirable to obtain uterine relaxation.
b. Salbutamol (Ventolin Solution for Intravenous infusion) is marketed by Allen & Hanburys Limited for the management of premature labour.
I am advised that there are other beta adrenergic agonists which have also been used in the treatment of premature labour."
See Hollingsworth, M. & Schnieden, H. (1973) for an English paper on salbutamol; and see Dellenbach, P. & Vors, J. (1972) for a French paper.
4. The three drugs mentioned in the British Medical Journal article are ritodrine, terbutaline, see Ingermarsson, I. (1976); Andersson, K.E. *et al* (1975); Akerlund, M. *et al* (1976) and nylidrin, see Castren, O. *et al* (1975)
5 Comparative trials in Germany show fenoterol as producing the minimum maternal and fetal tachycardia: Hüter, J. *et al* (1972); Stockhausen, H. *et al* (1972); Mosler, K.H. *et al* (1974)
6 Lancet (1974)
7 Bishop, E.H. & Woutersz, T.B. (1961); Hendricks, C.H. *et al* (1961); Brücke, F. *et al* (1956)
8 Eskes, T. *et al* (1966); the drug was supplied by Boehringer-Ingelheim suppliers of partusisten (fenoterol).
9 Hüter, J. *et al* (1974). There are many other papers on the effect of these adrenergic drugs on foetal distress and notably hypoxia resulting from labour contractions, see for example:
Künzel, W. & Mestwerdt, W. (1973); Schmidt, J. & Hirdes, G. (1974); Mosler, K.H. (1970); Mosler, K.H. *et al* (1974); Caldeyro-Barcia, R. *et al* (1969). Canadian and American surveys have also shown an increased perinatal and neonatal mortality and increased neurological damage to be associated with unduly short first and second stages of labour, particularly for primaparae where lowest perinatal mortalities are for 8 to 24 hours for the first stage and 1 to 2 hours for the second stage, Butler, N.R. & Bonham, D.G. (1963) 157-158; Niswander, K.R. & Gordon, M. (1972) 292-351; Ontario (1967) 188-189.
10 The paper from Churchill Hospital Oxford is: Baillie, P. *et al* (1970) but this study used a drug not now recommended.
11 Hollingsworth, M. & Schnieden, H. (1973)
12 Liggins, G.C. & Vaughan, G.S. (1973)
13 Wesselius-de Casparis, A. *et al* (1971)
14 Butler, N.R. & Bonham, D.G. (1963) 117 Table No. 36. This table expresses mortality as a Mortality Ratio (M). Table 2.1 uses the approximate conversion factor when M = 100 perinatal mortality = 34.9. This should be somewhat too high from the survey data but is close to the national figure of 35.0 in that year in England and Wales. The precise value does not affect the argument.
15 Ontario (1967)
16 Cunningham, G.C. *et al* (1976)
17 Chamberlain, R. *et al* (1975) 50
18 Amarasingham, J.L. *et al* (1975)
19 U.S. National Center for Health Statistics (1970) 26
20 Butler, N.R. & Alberman, E.D. (1969) 48
21 U.S. National Center for Health Statistics (1976) 7

22 See Bourne, A.W. & Burn, J.H. (1928)
23 Butler, N.R. & Bonham D.G. (1963) 183-185
24 Court Report (1976) 119. A team from the Department visited 8 hospital obstetric units to 'gather impressions' about induction during 1975. Such an inspection is not an evaluation. See Annual Report of the Chief Medical Officer of DHSS for 1975 60
25 *Ventolin (salbutamol BP)* published by Allen & Hanburys Ltd.
26 Bayer, H. *et al* (1976)
27 Hübschen, K. (1975)
28 Bärmig, H. & Krzoska, C. (1976). The 42 live births included one spina bifida who died, and one baby under 2500g and 40 normal, all allegedly from stopped abortions under sixteen weeks' gestation.
29 Alberman, E. *et al* (1975); Boué, J.G. & Boué, A. (1973) (1977); Macnin, G.A. (1974)
30 Akerlund, M. *et al* (1976)
31 Günther, H. & Kunze, M. (1976) is a German paper on rupture of membranes and premature birth discouraging artificial rupture. Bayer, H. *et al* (1976) recommends that membranes should be kept intact as long as possible.
32 Butler, N.R. & Bonham, D.G. (1963)
33 Mosler, K.H. (1969); Boden, W. & Crabben, H. (1970); Stockhausen, H. *et al* (1972); Maiss, C. & Legerlotz, C. (1972); Künzel, W. (1974); Lippert, T.H. *et al* (1976); Hüter, J. *et al* (1972)
34 Hüter, J. *et al* (1972)
35 Rippert, C. *et al* (1971); Brettes, J.P. *et al* (1976); Lippert, T.H. *et al* (1976); these papers are respectively German, French and Swiss and include extensive bibliographies.
36 Mosler, K.H. (1975) includes 36 references; Weidinger, H. & Wiest, W. (1973) gives about 100 references mostly German.
37 Chamberlain, R. *et al* (1975) 40-41
38 Butler, N.R. & Alberman, E.D. (1969) 122-140
39 Sachs, H. & Kühl, H.O. (1977)
40 Scholtes, G. (1974)
41 Hübschen, K. (1975); Baumgarten, K. (1974)
42 Leetz, I. (1976)
43 Komaromy, B. & Lampe, L. (1969)
44 Kyank, H. *et al* (1975)
45 Mendez-Bauer, C. *et al* (1976)
46 Milner, R.D.G. (1975)
47 Kloosterman, G.J. *et al* (1976)
48 Knorre, P. (1976) 591-592
49 Dunn, P.M. (1976)
50 There are many papers showing induced abortion and dilatation and curettage causing trauma to the basal layer of the endometrium and myometrium with resulting uterine atresia or Asherman's syndrome. Asherman's syndrome may produce premature labour, abnormal presentation, spontaneous abortion and abnormal implantation. The extensive literature on Asherman's syndrome goes back to the 19th century. Two American papers are: Carmichael, D.E. (1970); Comminos, A.C. & Zourlas, P.A. (1969). There is a Swedish monograph; Bergman, P. (1961). There are other papers showing direct association between induced abortion and subsequent faulty implantation, for example: Lembrych, S. (1972) and Cernoch A. (1971). There is a German book from the University of Munich showing the association between faulty implantation and a previous dilatation and curettage, and the association between faulty implantation and congenital malformations: Krone, H.A. (1961); this book includes 400 references.
51 Some German papers give severe infection including chorioamnionitis as a contraindication to the use of delaying drugs or as a "relative" contraindication to be weighed in the balance: Hüter, J. *et al* (1972). The importance of treating infection before an obstetric emergency arises is apparent.
52 Klein, J.O. & Marcy, S.M. (1973); see also Wynn, M. and Wynn, A. (1976) 20-26 introducing the French literature on infection in pregnancy.
53 Lupan, C. *et al* (1975) is a recent paper, and one of a number, showing impressive reductions in premature birth and spontaneous abortions following systematic treatment of bacteriuria with antibiotics. It is not, however, clear from this and other papers that the beneficial result does not follow from the effect of the antibiotics on infections of the cervix, membranes and other pelvic organs. Control of infection as part of antenatal care is discussed in Chapter Four.
54 Bengtsson, L.P. (1968)

CHAPTER THREE NOTES

1 Ontario (1967) 229-231
2 Cunningham, G.C. *et al* (1976)
3 Suranyi, S. *et al* (1976)
4 Bayer, H. & Issel, E.P. (1976)
5 Elder, M.G. *et al* (1970)
6 Pearson, J.F. & Weaver, J.B. (1976)
7 Saling, E. (1972)
8 Estel, C. *et al* (1977) is a recent German paper using the concepts of fixed and variable factors. There is an extensive literature on risk assessment in pregnancy.

CHAPTER FOUR NOTES

1 Ferster, G. and Jenkins, D.M. (1976) 729
2 Richardson, J.A. and Dixon, G. (1976)
3 The earliest papers on cervical incompetence as an important cause of spontaneous abortion were: Palmer, R. et Lacomme, M. (1948), Lash, A.F. and Lash, S.R. (1950) The cerclage operation is also called the 'Shirodkar'. For the history of the operation named after him see Shirodkar, V.N. (1970)
4 A Finnish paper expressly records the failure of delaying drugs in some cases of cervical incompetence: Kauppila, O. *et al* (1974); there are many papers on combined use of both delaying drugs and cerclage: see for example Jürgens, H. *et al* (1976)
5 Jiratko, K. *et al* (1977); Bayer, H. (1977)
6 See Swedish monograph: Bengtsson, L.P. (1968). Soutoul, J.H. *et al* (1975) is a recent French review with 118 references; Döring, G.K. (1965) is a German review summarising the results of 30 series of operations in different centres; Kidess, E. *et al* (1973) is a more recent German review with 22 references. Jennings, C.L. (1972) is a recent American paper. Haldemann, R. *et al* (1976) is a recent Swiss paper showing about 10 per cent of premature births as attributable to cervical incompetence.
7 The prevalence of cervical incompetence is shown in different populations to vary from less than 1 case in 1000 to over 5 per cent of women of reproductive age: Kidess, E. *et al* (1973); Moser, R. & Baur, B. (1974)
8 Widmaier, G. & Reichardt, H.D. (1973); Kubinyi, J. *et al* (1975); Wren, B.G. (1973)
9 Weidinger, H. & Wiest, W. (1973)
10 From Scottish Maternity Statistics 1970-1973 of the Scottish Health Service
11 McKinlay, J.B. (1970)
12 Heward, J.A. and Clarke, M. (1976) 1203
13 Zahn, V. & Johannigmann, J. (1975). Portable tocographs are supplied by Kranzbühler, Solingen.

14 Zahn, V. (1973)
15 Günther, H. & Kunze, M. (1976)
16 Bramley, M. (1976)
17 Cassie, R. & Stevenson, A. (1973)
18 See for example Grice, A.C. (1974); Walther, H. (1973); Schnell, J.D. *et al* (1972); Zakharchuk, S.S. *et al* (1972)
19 Kass, E.H. & Zinner, S.H. (1973). This review includes 69 references. There have been many reports of a reduction in preterm birth or low birthweight prevalence by the treatment of bacteriuria with antibiotics; see for example Wren, B.G. (1970); Lupan, C. *et al* (1975). However, Elder, H.A. *et al* (1967) (1968) showed in double-blind controlled trials that significant reductions in low birthweight percentages resulted from antibiotic treatment in populations of pregnant women with and without bacteriuria.
20 Fedrick, J. & Anderson, A.B.M. (1976); Fedrick, J. (1976)
21 Major, B. & Rothe, J. (1976) summarizes some results from East German records.

CHAPTER FIVE NOTES

1 Chamberlain, R. *et al* (1975) 17 85
2 Adapted from Thalhammer, O. (1967). A number of German writers follow the same classification as Professor Thalhammer with minor modification, see Reiher, H. & Steinhoff, R. (1976)
3 Wynn, M. & Wynn, A. (1974)
4 Sweden (1973)
5 Sunderström-Feigenberg, K. (1976)
6 Thalhammer, O. (1967) 385
7 There are a number of books on infection in pregnancy and an extensive world literature: See Thalhammer, O. (1967); a more recent German review paper is Müller, R. & Bergleiter, R. (1973); some of the French literature on infection in pregnancy was recently reviewed by the authors: Wynn, M. & Wynn, A. (1976); Charles, D. & Finland, M. (1973) is a valuable American symposium from Boston; Ciba Foundation (1973) is a shorter British symposium. The large literature includes many contradictions expected in a subject developing quite rapidly.
8 Department of Health and Social Security (1977) 178
9 Müller, R. & Bergleiter, R. (1973)
10 Axelrod, A.E. (1973) is a major review on the effect of nutrition on immunity to disease with 102 references.
11 U.S. Center for Disease Control (1972), Volume V of this survey gives much data on the spread of nutritional intakes.
12 Singer, J.E. *et al* (1968) Table 5 420
13 Fedrick, J. & Anderson, J.B.M. (1976) Tables VII and VIII.
14 Wynn, M. & Wynn A. (1975) is a review of Canadian literature on nutrition counselling in pregnancy.
15 Wynn, M. & Wynn, A. (1977)
16 See Arvay, A. *et al* (1967); Atanasov, A. *et al* (1972); Drac, P. & Nekvasilova, Z. (1970); Fuchs, V. *et al* (1970); Ruzicska, G. & Szucs, G. (1971a); Harlap, S. & Michael Davies, A. (1975); Knofre, P. (1976); Lembrych, S. (1972); Pantelakis, S.N. *et al* (1973); Papaevangelou, G. *et al* (1973); Renaud, R. & Van Lierde, M. (1974)
17 Richardson, J.A. & Dixon, G. (1976); there is another English paper showing similar results but on a smaller number of patients: Wright, C.S.W. *et al* (1972)
18 Dziewulska, W. (1973)
19 Ruzicska, G. & Szücs, G. (1971a)
20 Liu, D.T.Y. (1973); Hulka, J.F. (1974)
21 Weidinger, H. & Wiest, W. (1974)
22 In Schwerin District Hospital and associated women's clinics all women are examined for cervical incompetence as part of antenatal care. Papers from this District Hospital include: Zwahr, C. *et al* (1974); Zwahr, C. (1975); Knorre, P. (1976).This is also the practice at the Medical University of Debrecen, Hungary, and associated clinics: Ruzicska, G. & Szücs, G. (1971b) Examination of all women for cervical incompetence as part of antenatal care is also the practice in at least some important hospitals and associated women's clinics in Sweden. In West Germany it is recommended that at least all women who have had induced abortions should be examined for cervical incompetence in a subsequent pregnancy: Kirchhoff, H. (1974). This is also the recommendation in Czechoslovakia: Kotasek, A. (1976). It is recommended in France that all women who have had a previous induced abortion should be referred to an obstetric clinic for specialist examination in a subsequent pregnancy: Renaud, R. & Van Lierde, M. (1974)
23 Skala, V. (1970); Karutz, P. (1975)
24 Schofield, C.B.S. (1972) 138; Pschyrembel, W. (1968); Mesko, M. *et al* (1972)
25 Spence, J.C. (1975)
26 Trichopoulos, D. *et al* (1976). This Greek paper in a British journal shows a 3.4 times greater prevalence of infertility among women who have had an induced abortion. There are many similar papers. This particular paper attributes this result to infection. If there was a higher prevalence of infection among the population of women who had abortions than in the general population, before or after the abortion, this might be expected. Some of the same authors have also reported a higher prevalence of ectopic pregnancy among the women who have abortions: Panayotou, P.P. *et al* (1972); Pantelakis, S.N. *et al* (1973) gives other Greek references. Cernoch, A. (1971) is a paper on the association of induced abortion and ectopic pregnancy on a larger canvas.
27 Divis, J. *et al* (1970)
28 Müller, J. & Jäger, G. (1975)
29 Akkermann, S. *et al* (1976); Eggers, H. (1976)
30 Räihä, C.E. (1962)
31 Ingerslev, M. & Pedersen, G.T. (1960)
32 Thalhammer, O. (1967) 402 - 403
33 Schroeder, R. (1950). This is a summary of a symposium on the effect of work on the outcome of pregnancy at which much information was presented.
34 Räihä, C.E. (1963)
35 Jeffrey, R.L. *et al* (1974); Weekes, A.R.L. *et al* (1977); Leetz, I. (1976)
36 Soutoul, J.H. *et al* (1975)
37 The Regional Office for Europe of the World Health Organization convened a conference on maternal and child health on 11-15 November 1974 in Moscow. The Russian chairman was Professor Elena C. Novitsova who made a special point of describing the sanatorium-type care for selected women during the last trimester of pregnancy. Projects such as the "Kalinin Project" using this type of care are described in papers in Soviet medical journals for example: Kurisheva, K.A. *et al* (1972). A French medical delegation to the U.S.S.R. confirmed that it had proved possible to reduce the prevalence of low birthweight from 8 per cent or more to 4 per cent, and that a major means of achieving this result was the transfer of women showing "the least symptoms of abnormality" to a sanatorium for pregnant women, while a home-help was appointed to look after the home: Sénécal, J. (1975).
38 All the many establishments providing cures are regarded as an important arm of the health services in France and were the subject of a high level inquiry in 1970-1971 on the initiative of the then Minister of Health, Robert Boulin: France (1971b) vol 11 159-228
39 Germany (1975)

CHAPTER SIX NOTES

1 The French programmes for perinatal prevention in the French Sixth Plan allocated over half all the additional expenditure to improvements in antenatal care: France (1970) (1971b); France (1971c) vol 1 127-128; Wynn, M. & Wynn, A. (1976)

2 See French estimates of the high cost of handicap France (1970). There is an extensive literature on the economic cost of mortality, but, however it is estimated, handicap is much more expensive than mortality and this is shown in the French cost-benefit studies.
3 Rooth, G. (1976). The French studies also show about two handicapped survivors for every perinatal death.
4 Court Report (1976) 121-122
5 Wynn, M. & Wynn, A. (1976) 11
6 Wesselius-De Casparis, A. *et al* (1971)
7 Royal College of Midwives (1977) para 2.2.2
8 France (1973) 159
9 France (1976b) 106
10 Smyth, C.N. (1974)
11 France (1976a)
12 France (1971a) (1971c)
13 Rexed, B. (1976)
14 Alm, I. (1953)
15 Rooth, G. (1976) 11
16 Marshall, A. (1927) 217

REFERENCES

AKERLUND, M., ANDERSSON, K.E. & INGEMARSSON, I. (1976) 'Effects of terbutaline on myometrial activity, uterine blood flow, and lower abdominal pain in women with primary dysmenorrhoea' *Brit. J. Obstet. & Gynaec. 83/9* 673-678

AKKERMANN, S., TOWE, J. & VOIGT, M. (1976) 'Zum Einfluss sozialer Faktoren auf die Beziehungen zwischen mütterlicher Berufstätigkeit und Frühgeborenenquote' *Zbl. Gynak. 98* 193-199

ALBERMAN, E., ELLIOTT, M., CREASY, M. & DHADIAL R. (1975) 'Previous reproductive history in mothers presenting with spontaneous abortions' *Brit. J. Obstet. & Gynaec. 82* 366-373.

ALLMÄN HÄLSO-OCH SJUKVÅRD (1973) Sveriges officiella statistik Stockholm.

ALM, I. (1953) 'The long-term prognosis for prematurely born children' *Acta. Paediat. Scand.* Suppl. 42

AMARASINGHAM, J.L., TAN KENG WEE, CHOO, H.T., CHENG, P. & TAN CHENG LIM (1975) 'Prevention of respiratory distress syndrome and postponement of premature labour' *Mod. Med. Asia 11*/12 6 - 12

ANDERSSON, K.E., BENGTSSON, L.P., GUSTAFSON, I. & INGEMARSSON, I. (1975) 'The relaxing effect of terbutaline on the human uterus during term labour' *Amer. J. Obstet. Gynec. 121*/5 602-609

ARVAY, A., GÖRGEY, M. & KAPU, L. (1967) 'La relation entre les avortements (interruptions de la grossesse) et les accouchements prématurés' *Rev. Franc. Gynec. 62* 81-86

ATANASOV, A., VASILEV, D. & HADIJEV, A. (1972) 'Influence of induced abortion on the course of a subsequent pregnancy and birth' (trans) *Akus. i Ginek. 11* 398-402

AXELROD, A.E. (1973) 'Nutrition in relation to acquired immunity' in Goodhart, R.S. & Shils, M.E. (1973) *Modern Nutrition in Health and Disease* Lea & Febiger 493-505

BAILLIE, P., MEEHAN, F.P. & TYACK, A.J. (1970) 'Treatment of premature labour with orciprenaline' *Brit. Med. J. 4* 154-155

BÄRMIG, H. & KRZOSKA, C. (1976) 'Behandlung des drohenden frühabortus (6 bis 16 Schwangerschaftswoche) mit Th 1165a Partusisten' *Zbl. Gynak 98* 792-794

BAUMGARTEN, K. (1974) 'Indikationen und Kontraindikationen zur Anwendung von betamimetischen Substanzen in der Geburtshilfe' in *6 Deutscher Kongress fur Perinatale Medizin 1973* Thieme, Stuttgart.

BAYER, H. (1977) 'Einige neue Gesichtspunkte bei der Prophylaxe und Therapie der drohenden Frühgeburt' *Zbl. Gynak. 99* 547-551

BAYER, H. & ISSEL, E.P. (1976) 'Die Beendigung der Geburt unter den modernen Methoden der intranatalen Intensiv-überwachung' *Z. arzt. Fortbild 70*/20 1041

BAYER, H., ISSEL, E.P., HENGST, P., PRENZLAU, P. & HALLE, H. (1976) 'Die klinische Problematik der Frühgeburt *Zbl. Gynak. 98* 1025-1034 1035-1042

BENGTSSON, L.P. (1968) 'Cervical insufficiency' *Acta Obstet. Gynec. Scand. 47* Supp. 1

BERGMAN, P. (1961) 'Traumatic intra-uterine lesions' *Acta. Obstet. Gynec. Scand. 40* suppl. 4. 39

BISHOP, E.H. & WOUTERSZ, T.B. (1961) 'Isoxsuprine, a myometrial relaxant' *Obstet. & Gynec. 17* 442-446

BODEN, W. & CRABBEN, H. (1970) 'Wehenhemmung mit einer neuen beta-adrenergen Substanz' *Med. Welt 21*/30 1342-1349

BOUE, J.G. & BOUE A. (1973) 'Chromosomal analysis of two consecutive abortuses in each of 43 women' *Humangenetik 19* 275

BOUE A. & BOUE, J. (1977) 'Le Rôle des anomalies chromosomiques dans les échecs de la réproduction' *J. Gyn. Obst. Biol. Repr. 6* 5-21

BOURNE, A.W. & BURN J.H. (1928) 'The action of oxytocin and vasopressin on the uterus in labour' *Lancet 2* 694

BRAMLEY, M. (1976) 'Study of female babies of women entering confinement with vaginal trichomoniasis' *Brit. J. Vener. Dis. 52* 58-62

BRETTES, J.P., RENAUD, R. & GANDAR, R. (1976) 'A double-blind investigation into the effects of ritodrine on uterine blood flow during the third trimester of pregnancy' *Amer. J. Obstet. & Gynaec. 124* 164-168

BRITISH MEDICAL JOURNAL (1977) 'Postponing premature labour' 1 118-119

BRITISH MEDICAL JOURNAL (1977) 'Preventing prematurity in twins' 2 1618

BRÜCKE, F., HERTTING, G., LINDNER, A. & LOUDON, M. (1956) 'Zur Pharmacologie einer neuen gefässerweiternden Substanz aus der p-Oxy-Ephedrin-Reihe' *Wien, klin. Wochenschr. 68* 183

BUTLER, N.R. & ALBERMAN, E.D. (1969) *Perinatal Problems* Livingstone

BUTLER, N.R. & BONHAM, D.G. (1963) *Perinatal Mortality* Livingstone

CALDEYRO-BARCIA, R., MAGANA, J.M., CASTILLO, J.B., POSEIRO, J.J., MENDEZ-BAUER, C., POSE, S.V., ESCARCENA, L., CASACUBERTA, C., BUSTOS, J.R. & GIUSSI, G. (1969) 'A new approach to the treatment of acute intrapartum fetal distress' in *Perinatal Factors affecting Human Development* 248-253 Pan-American Health Organization, World Health Organization, Washington.

CANADA (1975) *Annual Report,* Federal Division of Vital Statistics Ottawa

CARMICHAEL, D.E. (1970) 'Asherman's syndrome' *Obstet. Gynec. 36* 922

CASSIE, R. & STEVENSON, A. (1973) 'Screening for gonorrhoea, trichomoniasis, moniliasis and syphilis in pregnancy' *J. Obstet. Gynaec. Brit. Cwlth. 80* 48

CASTREN, O., GUMMERUS, M. & SAARIKOSKI, S. (1975) 'Treatment of imminent premature labour' *Acta Obstet. & Gynec. Scand. 54* 95-100

CAVANAGH, D. & TALISMAN, M.R. (1969) *Prematurity and the Obstetrician* Meredith New York

CERNOCH, A. (1971) 'Künstliche Schwangerschaftsunterbrechung und extrauterine Schwangerschaft' *Zbl. Gynak. 93* 1784

CHAMBERLAIN, R., CHAMBERLAIN, G., HOWLETT, B. & CLAIREAUX, A. (1975) *British Births 1970: Vol. 1 The First Week of Life* Heinemann.

CHARLES, D. & FINLAND, M. (1973) *Obstetric and Perinatal Infections* Lea & Febiger Philadelphia

CIBA FOUNDATION (1973) *Intrauterine Infections* Elsevier Amsterdam

COMMINOS, A.C., & ZOURLAS, P.A. (1969) 'Treatment of uterine adhesions (Asherman's syndrome)' *Amer. J. Obstet. Gynec. 105* 862

COURT REPORT (1976) *Fit for the Future; the report of the Committee on Child Health Services* Cmnd. 6684 HMSO

CUNNINGHAM, G.C., HAWES, W.E., MADORE, C., NORRIS, F.D. & WILLIAMS, R.L. (1976) *Intrauterine Growth and Neonatal Risk in California* Department of Health Sacramento

DAVIE, R., BUTLER, N. & GOLDSTEIN, H. (1972) *From Birth to Seven* Longman & National Children's Bureau.

DELLENBACH, P. & VORS, J. (1972) 'Intérêt du Salbutamol en Obstetrique' *Therapeutique 48* 671-675

DEPARTMENT OF HEALTH AND SOCIAL SECURITY (1975) *Memorandum on Maternal Care by General Practitioners* SFA 14 paragraph 31/schedule 3

DEPARTMENT OF HEALTH AND SOCIAL SECURITY(1976a) *Prevention and Health: Everybody's Business* HMSO

DEPARTMENT OF HEALTH AND SOCIAL SECURITY (1976b) *Priorities for Health and Personal Social Services in England* HMSO
DEPARTMENT OF HEALTH AND SOCIAL SECURITY (1977) *Health and Personal Social Services Statistics for England* 1976 HMSO
DIVIS, J., NOVOTNY, Z., MACHOVA, E. & JANSA, S. (1970) 'Inflammation of the pelvic organs following the artificial termination of pregnancy' (trans.) *Cesko. Gynek. 35/6* 371-372
DÖRING, G.K. (1965) 'Unsere Erfahrungen in der Behandlung der Zervixinsuffizienz mit der Shirodkar-Operation' *Geburts. u. Frauenheilk. 25* 412-420
DRAC, P. & NEKVASILOVA, Z. (1970) 'Preterm birth in pregnancies following a previous abortion' (trans.) *Cesko. Gynek. 35* 332-333
DUNN, P.M. (1976) 'Maternal and Fetal Aetiological Factors' in Rooth, G. & Bratteby, L.E. *Perinatal Medicine* Fifth European Congress of Perinatal Medicine, Uppsala 76-81
DZIEWULSKA, W. (1973) 'Abortion in the past and the fate of a subsequent pregnancy' (trans.) *Gin Pol. 44* 1010 - 1148
EGGERS, H. (1976) 'Epidemiologische Studie über Zusammenhänge zwischen sozialen Risikofaktoren, Schwangerschaftsverlauf und niedrigen Geburtsgewicht' *Dtsch. Ges. Wesen 31* 1926-1931
ELDER, H.A., SANTAMARINA, B.A.G., SMITH, S.A. & KASS, E.H. (1967) 'Excess prematurity in tetracycline treated bacteriuric patients whose infection persisted or returned' *Antimicrob. Agents Chemother.* 101 1968
ELDER, H.A., SMITH, R. & KASS, E.H. (1968) 'Effects of tetracycline on outcome of pregnancy in non bacteriuric patients' Eighth Interscience Conference on Antimicrobial Agents and Chemotherapy New York
ELDER, M.G., BURTON, E.R., GORDON, H., HAWKINS, D.F. & MCCLURE-BROWNE, J.C. (1970) 'Maternal weight and girth changes in late pregnancy and the diagnosis of placental insufficiency' *J. Obstet. & Gynaec. Brit Com. 77/6* 481-491
ESKES, T., SEELEN, J. & VAN GENT, I. (1966) 'The effect of Beta-mimetic adrenergic drugs on the activity of the pregnant human uterus' *Arzneimittel-Forsch. 16* 762-766
ESTEL, C., SEEWALD, H.J., SCHMIDT, B. & BOHN, J. (1977) 'Über die praktische Anwendung eines Risikopunktkatalogs zur Früher kennung von Prä- und Dysmaturität' *Zbl. Gynak. 99* 193-196
EUROPEAN CONGRESS OF PERINATAL MEDICINE (1976) *Proceedings of 5th* Uppsala, Sweden 9-12 June
FEDRICK, J. (1976) 'Antenatal identification of women at high risk of spontaneous preterm birth' *Brit. J. Obstet. Gynaec. 83/5* 351-354
FEDRICK, J. & ANDERSON, A.B.M. (1976) 'Factors associated with spontaneous preterm birth' *Brit. J. Obstet. Gynaec. 83/5* 342-350
FERSTER, G. & JENKINS, D.M. (1976) 'Patterns of antenatal care, perinatal mortality, and birthweight in three consultant obstetric units' *Lancet 2* 727-729
FRANCE (1970) *La Périnatalité: Etude de Rationalisation des Choix Budgétaires* (RCB) Ministère de la Santé Publique
FRANCE (1971a) *6e Plan: Handicapés- Inadaptés* Commissariat Général du Plan
FRANCE (1971b) *Pour une Politique de la Santé; les grandes actions de santé* Ministère de la Santé Documentation Francaise
FRANCE (1971c) *6e Plan : Santé* 3 vols Commissariat Général du Plan
FRANCE (1973) *La Prevention* Inspection Générale des Affaires Sociales
FRANCE (1976a) *La politique de la famille* Premier Ministre; Service d'Information et de Diffusion
FRANCE (1976b) *7e Plan: Santé et Assurance Maladie* Commissariat Général du Plan
FUCHS, V., BRUTAR, V. & HOUDEK, J. (1970) 'Cervical insufficiency following previous induced abortion' (trans.) *Cesko. Gynek. 35* 365
GERMANY (1975) *Für Uns; Hilfen für die Familie* Bundesministerium für Jugend Familie und Gesundheit
GRICE, A.C. (1974) 'Vaginal infection causing spontaneous rupture of the membranes and premature delivery' *Aust. N.Z. J. Obstet. Gynec. 14* 156-158
GUNTHER, H. & KUNZE, M. (1976) 'Vorzeitiger Blasensprung und Frühgeburt' *Zbl. Gynäk. 98* 1383-1388
HALDEMANN, R., GIGON, O., BAUR, B., PUSTERLA, E. & SIDIROPOULOS, D. (1976) 'Statistische Auswertung von amnestischen und klinischen Befunden bei einem Frühgeburtenkollektiv von 245 Fällen' *Zbl. Gynäk. 98* 468-474
HARLAP, S. & MICHAEL DAVIES, A. (1975) 'Late sequelae of induced abortion: complications and outcome of pregnancy and labour' *Amer. J. Epidem. 102* 217-224
HENDRICKS, C.H., CIBILS, L.A., POSE, S.V. & ESKES, T.K.A.B. (1961) 'The pharmacologic control of excessive uterine activity with isoxsuprine' *Amer. J. Obstet. Gynec. 82* 1064-1078
HEWARD, J.A. & CLARKE, M. (1976) 'Communications to an antenatal clinic' *Brit. Med. J. 1* 1201-1204
HOLLINGSWORTH, M. & SCHNIEDEN, H. (1973) 'Salbutamol and inhibition of uterine contractions' *J. Pharm. Pharmac. 25* 996-998
HUBSCHEN, K. (1975) 'Die Behandlung der vorzeitigen Wehentätigkeit mit Partusisten' *Med. Welt 26* 1188-1192
HULKA, J.F., LEFLER, H.T., ANGLONE, A. & LACHENBRUCH, P.A. (1974) 'A new electronic force monitor to measure factors influencing cervical dilation for vacuum curettage' *Amer. J. Obstet. Gynec. 120* 166-173
HUTER, J., BAUMGARTEN , K., JUNG, H., MELCHIOR, J., MOSLER, K.H. & WEIDINGER, H. (1974) 'Medikamentöse Wehenhemmung; ein schriftliches Symposium' *Geburtsh. u. Frauenheilk 34* 689-698
HUTER, J., RIPPERT, C & MEYER, C. (1972) 'Wehenhemmung mit welchem Beta-Mimetikum (Berotec, Ritodrine, Dilatol)' *Geburtsh. u. Frauenheilk. 32* 97-103
HYTTEN, F.E. & LEITCH, I. (1971) *The Physiology of Human Pregnancy* Blackwell
INGERMASSON, I. (1976) 'Effect of terbutaline on premature labour' *Amer. J. Obstet. and Gynaec. 125* 520-524
INGERSLEV, M. & PEDERSEN, G.T. (1960) 'Perinatal mortalitet i 2 danske amter' *XI Nord. Kongr. Obst. Gyn.* Helsinki
JEFFREY, R.L., BOWES, W.A. & DELANEY, J.J. (1974) 'Role of bed rest in twin gestation' *Obstet. & Gynec. 43* 822
JENNINGS, C.L. (1972) 'Temporary sub-mucosal cerc[illegible]e for cervical incompetence; report of 48 cases' *Amer. J. Obstet. Gynec. 113* 1097-1102
JIRATKO, K., BARAN, P. & ZABRANSKY, F. (1977) 'Über unsere Erfahrungen mit dem Mayer-Ringpessar in der Prävention der frühzeitigen Geburt' *Zbl. Gynäk. 99* 220-228
JURGENS, H., KOPPE, I. & FRICKE, U. (1976) 'Kombination von Zerklage und medikamentöser Tokolyse bei drohender Frühgeburt' *Zbl. Gynäk. 98* 245-249
KARUTZ, P., SCHUMANN, A. & SCHULZ, S. (1975) 'Die kulturelle Diagnostik der Gonorrhoe an der Frauenklinik des Bezirkskrankenhauses Brandenburg mit Hilfe des Transportmediums nach Stuart' *Dt. Gesundh. Wesen 30/10* 449-453
KASS, E.H. & ZINNER, S.H. (1973) 'Bacteriuria and pyelonephritis' in Charles, D. & Finland, M. *Obstetric and Perinatal Infections* Lea & Febiger 407-446
KAUPPILA, O., PYSTYNEN, P. & VAALAMO, P. (1974) 'Über die Indikationen der Zervixcerclage' *Zbl. Gynäk. 96* 361-365
KIDESS, E., PROBST, V. & FIECHTNER, E. (1973) 'Indikationsstellung und Erfolge der Zervixcerclage in der Schwangerschaft' *Geburtsh. u. Frauenheilk. 33* 198-202
KIRCHHOFF, H. (1974) 'Verlauf von Schwangerschaft und Geburt nach vorausgegangenem legalem Schwangerschaftsabbruch' *Z Geburtsh. Perinat. 178* 407-414
KLEIN, J.O. & MARCY, S.M. (1973) 'Infection in the Newborn' in Charles, D. & Finland, M. (1973) *Obstetric and Perinatal Infections* Lea & Febiger 127-164
KLOOSTERMAN, G.J., OTTEN, J.A., SCHREGARDUS, F., SCHUTTE, M.F., TREFFERS, P.E. & VAN WERING, J.H. (1976) 'Evaluation of Breech Delivery' paper no. 32 *5th European Congress of Perinatal Medicine* Uppsala June 1976
KNORRE, P. (1976) 'Über den Einfluss von Aborten und Schwangerschaftsunterbrechungen auf nachfolgende Geburten' *Zbl. Gynäk. 98* 587-590 591-592 595-599
KOMAROMY, B. & LAMPE, L. (1969) 'Die Bedeutung und die Möglichkeiten der frühzeitigen Erkennung einer Zwillingsschwangerschaft' *Zbl. Gynäk. 91* 1378-1387
KOTASEK, A. (1976) 'Medical consequences of induced abortion and its effect on subsequent pregnancy' *4th International Congress on Perinatal Medicine,* Prague January 1975, republished *Human Life Review* 1976, 118-126
KRONE, H.A. (1961) *Die Bedeutung der Eibettstörungen für die Entstehung menschlicher Missbildungen* Gustav Fischer Stuttgart
KUBINYI, J., PILISHEGYI, J. & LACZA, A. (1976) 'Die Rolle der Zerklage bei der Verhütung der Fehlgeburt und der Frühgeburt' *Zbl. Gynäk. 98* 1043-1048
KUNZEL, W. (1974) 'Die Wehenhemmung vor und während der Geburt' *Med. Monatssch. 22/2* 2-12

KÜNZEL, W. & MESTWERDT, W. (1973) 'Die Anwendung von Tokolytika während der Geburt' *Niedersächsisches Ärzteblatt 46/22* 716-733
KURISCHEVA, K.A., SCHIMICHEVA, A.N., VOLINSKAJA, A.C. & IVANOVA, E.C. (1972) 'The organisation of specialist medical support for women during pregnancy and childbirth in the province of Kalinin' (trans.) *Voprosy Pediatrii i Okhrany Materinstva i Detstva. 17/3* 27-30
KYANK, H., HERRE, H.D., KRUSE, H.J., LÖSCHER, H., KETSCHER, K.D. & PLESSE, R. (1975) 'Ergebnisse einer Normalwerterhebung Neugeborener in der DDR' *Zbl. Gynäk. 97* 129-137
LAMBERT, P. (1976) 'Perinatal mortality in England and Wales' *Population Trends 4* 4-8 HMSO
LANCET (1974) 'Delaying premature Labour' *2* 875-876
LASH, A.F. & LASH, S.R. (1950) 'Habitual abortion: the incompetent internal os of the cervix' *Amer. J. Obstet. & Gynec. 59* 68-76
LEETZ, I. (1976) 'Untergewichtigkeit und Gefährdung der Mehrlinge' *Zbl. Gynäk. 98* 112-118
LEMBRYCH, S. (1972) 'Schwangerschafts- Geburts- und Wochenbettverlauf nach künstlicher Unterbrechung der ersten Gravidität' *Zbl. Gynäk. 94* 164-168
LIGGINS, G.C. & VAUGHAN, G.S. (1973) 'Intravenous infusion of salbutamol in the management of premature labour' *J. Obstet. Gynaec. Brit. Comm. 80* 29-32
LIPPERT, T.H., DE GRANDI, P.B. & FRIDRICH, R. (1976) 'Actions of the uterine relaxant fenoterol, on uteroplacental hemodynamics in human subjects' *Amer. J. Obstet. Gynec. 125/8* 1093-1098
LITTLE, W.J. (1862) 'On the influence of abnormal parturition, difficult labour, premature birth and asphyxia neonatorum on the mental and physical condition of the child especially in relation to deformities' *Trans. Obst. Soc. 3* 293
LIU, D.T.Y. (1973) 'Vaginal mid-trimester abortion' *Lancet 1* 433
LUPAN, C., DIMOFTACHE, E., SERBAN, D., LENGHEL, J. & RUSU, C. (1975) 'Prophylaxie de la pathologie obstétricale et neonatale par le dépistage et le traitement des bacteriuries asymptomatiques significatives en consultation externe' *Rev. franc. Gynec. 70/12* 721-726
LYNCH, M.A. (1975) 'Ill-health and child abuse' *Lancet 2* 317-319
MACHIN, G.A. (1974) 'Chromosome abnormality and perinatal death' *Lancet 1* 549-551
MAISS, C. & LEGERLOTZ, C. (1972) 'Über die tokolytische Wirksamkeit der betaadrenergan Substanz Th 1165a' *Therapiewoche 22/21* 1797/1805
MAJOR, B. & ROTHE, J. (1976) 'Ein Beitrag zur Analyse der gestationsbedingten Morbidität in der DDR' *Zbl. Gynäk. 98* 200-211
MARSHALL, A. (1927) *Principles of Economics* eighth edition 1920 first published 1890 Macmillan
MCKINLAY, J.B. (1970) 'The new late comers for antenatal care' *Brit. J. Prev. Soc Med. 24* 52-57
MENDEZ-BAUER, C., ARROYO-FRADE, J., RUIZ CANSECO, A., MENENDEZ, A. & ZAMARRIEGO CRESPO, J. (1976) 'Management of breech presentation during pregnancy and labour' in *Perinatal Medicine* Fifth European Congress of Perinatal Medicine Uppsala 65-68
MESKO, M., LIPENSKY, S. & JEDINAK, J. (1972) 'Gonorrhoe bei Frauen vor der Interruptio' *Zbl. Gynäk. 94* 169-172
MILNER, R.D.G. (1975) 'Neonatal mortality of breech deliveries with and without forceps to the aftercoming head' *Brit. J. Obstet. & Gynaec. 82* 783-785
MOSER, R. & BAUR, B. (1974) 'Zur operativen Behandlung der Zervixinsuffizienz' *Geburtsh. u. Frauenheilk. 34* 1053-1054
MOSLER, K.H. (1969) 'Probleme der Wehenhemmung durch Pharmaka' *Med. Klin. 64/4* 133-139
MOSLER, K.H. (1970) 'Pharmacology of uterine inhibition'. In Caldeyro-Barcia, R. (1970) 'Symposium über uterushemmende Pharmaka' *Gyn. Rdsch. 9* 19
MOSLER, K.H. (1975) 'The treatment of threatened premature labor by tocolytics, Ca^{++} antagonists and anti-inflammatory drugs' *Arzneimittel Forsch. 25* 263-266
MOSLER, K.H., LINKA, F., DORNHÖFER, W. & EHRHART, J. (1974) 'Tocolytic therapy in obstetrics' *J. Perinat. Med. 2* 2 - 16
MULLER, R. & BERGLEITER, R. (1973) 'Die klinische Bedeutung intrauteriner Infektionen' *Zbl. Gynäk. 95* 1569-1578
MULLER, J. & JAGER, G. (1975) 'Collaboration between outpatient and inpatient services in handling proposals, decisions, operations and after-care in the district hospital of Meiningen' (trans.) *Zbl. Gynäk. 97* 95-98
NISWANDER, K.R. & GORDON, M. (1972) *The Women and their Pregnancies* U.S. Department of Health, Education & Welfare
OLIVER, J.E., COX, J., TAYLOR, A. & BALDWIN, J.A. (1974) *Severely ill-treated children in north-east Wiltshire* Oxford Regional Health Authority
ONTARIO (1967) *Second Report of the Perinatal Mortality Study* Ontario Department of Health
OPPE REPORT (1974) *Report of the Working Party on the Prevention of early Neonatal Mortality and Morbidity* Department of Health and Social Security London
PALMER, R. et LACOMME, M. (1948) 'La béance de l'orifice interne cause d'avortements à répétition' *Gyn. et Obst. 47* 905
PANAYOTOU, P.P., KASKAR ELIS, D.B., MIETTINEN, O.S., TRICHOPOULOS, D.B. & KALANDIDI, A.K. (1972) 'Induced abortion and ectopic pregnancy' *Amer. J. Obst. & Gynec. 114* 507
PANTELAKIS, S.N., PAPADIMITRIOU, G.C., DOXIADIS, S.A. (1973) 'Influence of induced and spontaneous abortions on the outcome of subsequent pregnancies' *Amer. J. Obstet. Gynec. 116* 799-805
PAPAEVANGELOU, G., PAPADATOS, C. & ALEXIOU, D. (1973) 'The effect of induced abortion on perinatal mortality' *Acta Eur. Fertil. 4* 7-10
PASAMANICK, B. (1975) 'Ill-health and child abuse' *Lancet 2* 550
PEARSON, J.F. & WEAVER, J.B. (1976) 'Fetal activity and fetal well-being : an evaluation' *Brit. Med. J. 1* 1305-1307
PEEL REPORT (1970) *Domiciliary Midwifery and Maternity Bed Needs* HMSO
PSCHYREMBEL, W. (1968) *Praktische Gynäkologie* Berlin
PUFFER, R.R. & SERRANO, C.V. (1973) *Patterns of Mortality in Childhood* Pan American Health Organization Washington
RÄIHÄ, C.E. (1962) 'Relation of maternal heart volume in pregnancy to prematurity and perinatal mortality' *Bull. World Health Org. 26* 296-300
RÄIHÄ, C.E. (1963) 'The possibilities of reducing perinatal mortality' *Ann. Paediat. Fenn. 9* 152
REIHER, H. & STEINHOFF, R. (1976) 'Das Problem der Frühgeburt aus geburtshilflicher Sicht' *Dt. Gesundh. Wesen 31* 2325-2330
RENAUD, R. & VAN LIERDE, M. (1974) 'Répercussions de l'avortement légal sur les grossesses ultérieures' *J. Gyn. Obst. Biol, Repr. 3* 577-594
REXED, B. (1976) 'Perinatal care in Sweden' in Rooth, G. & Bratteby, L.E. *Perinatal Medicine* 5th European Congress of Perinatal Medicine, Uppsala 26-28
RHYS-WILLIAMS REPORT (1963) *Report of the Maternity Services Emergency Informal Committee* National Birthday Trust Fund, London
RICHARDSON, J.A. & DIXON, G. (1976) 'Effects of legal termination on subsequent pregnancy' *Brit. Med. J. 1* 1303-1304
RIPPERT, C., HUTER, J. & WIRTSELN, R. (1971) 'Intravenöse Langzeit=Wehenhemmung mit Beta-Mimetika und Antagonisierung der Nebenwirkung' *Geburts. u. Frauenheilk. 8* 712
ROOTH, G. (1976) 'Socio-economic aspects of perinatal medicine' in Rooth, G. & Bratteby, L.E. *Perinatal Medicine* 5th European Congress of Perinatal Medicine Uppsala 76-81
ROYAL COLLEGE OF MIDWIVES (1977) *Evidence to the Royal Commission on the National Health Service*
RUZICSKA, G. & SZUCS, G. (1971a) 'The effects of artificially induced abortion on the successful conclusion of subsequent pregnancies' (trans.) *Magyar Noorvosok Lapja 34* 102-107
RUZICSKA, G. & SZUCS, G. (1971b) 'Our experience with the cerclage operation' (trans.) *Orvosi Hetilap 112* 1628-1631
SACHS, H. & KUHL, H.O. (1977) 'Lässt sich der hohe Prozentsatz frühgeborener Zwillingskinder reduzieren' *Zbl. Gynäk. 99* 552-563
SALING, E. (1972) 'Prämaturitäts- und Dysmaturitäts- Präventionsprogramm (PDP-Programm)' *Z. Geburtsh. u. Perinat. 176* 70-81
SCHMIDT, J. & HIRDES, G. (1974) 'Präoperative Tokolyse vor der Schnittentbindung' *Geburtsh. u. Frauenheilk. 34* 978-982
SCHNELL, J.D., ANDREWS, P. & PLEMPEL, M. (1972) 'Die vaginale Kontamination der weiblichen Bevölkerung einer Gros stadt mit Trichomonaden und Hefen' *Geburtsh. u. Frauenheilk. 32* 1007-1014
SCHOFIELD, C.B.S. (1972) *Sexually Transmitted Disease* Livingstone London
SCHOLTES, G. (1974) 'Erste Ergebnisse einer prophylaktishen Tokolytika-Gabe dei Zwillingsschwanger schaften' Vortrag auf der Tagung der Deutschen Gesellschaft für Gynäkologie *Arch. Gynaekol. 219 337-339*
SCHROEDER, R. (1950) 'Zusammenfassendes Referat über die Vorträge der Herrn Emmerich, Aresin, Sommer und Lork zum Thema

Frauenarbeit' *Zbl. Gynäk. 72* 1709
SCOTTISH HOME AND HEALTH DEPARTMENT (1974) *Maternity Discharge Records*
SENECAL, J. (1975) 'Politique périnatale: un bon example de planification en santé publique' *Arch. Franc. Ped. 32* 308
SHELDON REPORT (1971) *Report of the Expert Group on Special Care for Babies* HMSO
SHIRODKAR, V.N. (1970) 'Cervical incompetence and its treatment' in Sturgis, S.H. & Taymor, M.L. (1970) *Progress in Gynecology* Grune & Stratton
SINGER, J.E., WESTPHAL, M. & NISWANDER, K. (1968) 'Relationship of weight gain during pregnancy to birth weight and infant growth and development in the first year of life' *Obstet. & Gynec. 31* 417-423
SKALA, V. (1970) 'Consequences of artificial terminations of pregnancy' (trans.) *Cesko. Gynek. 35/6* 370-371
SMITH, S.M. & HANSON, R. (1974) '134 Battered Children: a medical and psychological study' *Brit. Med. J. 3* 666-670
SMYTH, C.N. (1974) 'Biomechanics and human parturition' *Proc. Roy. Soc. Med. 67* 193
SOUTOUL, J.H., BERGER, Ch., GALLIER, J., LISKA, G. & JANTSON, Ch. (1975) 'Les resultats des cerclages pour insuffisance cervico-isthmique' *Rev. Franc. Gynec. Obstet. 70* 2-12
SPENCE, J.C. (1975) 'Sexuality and contraception' *World Medicine 10/10* 55
STOCKHAUSEN, H., SCHNELL, J. & RUETHER, K. (1972) 'Die Tokolyse unter der Geburt' *Geburtsh. u. Frauenheilk. 32* 51-56
SUNDSTRÖM-FEIGENBERG, K. (1976) 'Befolkningsutveckling och abortlagstiftung' *Läkartidningen 73/44* 3747-3752
SURANYI, S., ENDRODI, J., TELKES, L., NAGY, J. & ZSIGMOND, K. (1976) 'Tocolysis by betamimetics and alcohol' paper no. 265 5th European Congress of Perinatal Medicine Abstracts Uppsala June 1976
SWEDEN (1973) *Förlossningsvardens Organisation* Socialstyrelsen Stockholm
THALHAMMER, O. (1967) *Pränatale Erkrankungen des Menschen* Thieme Stuttgart
TRICHOPOULOS, D., HANDANOS, N., DANEZIS, J., KALANDIDI, A. & KALAPOTHAKI, V. (1976) 'Induced abortion and secondary infertility' *Brit. J. Obstet. Gynaec. 83* 645-650
U.S. CENTER FOR DISEASE CONTROL (1972) *Ten-State Nutrition Survey 1968-1970* Atlanta
U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE (1972) *Mental Retardation, its biological factors* prepared by National Institute of Neurological Diseases and Stroke.
U.S. NATIONAL CENTER FOR HEALTH STATISTICS (1970) *National Statistics Analysis* Series 21 Number 19
U.S. NATIONAL CENTER FOR HEALTH STATISTICS (1972) *A Study of Infant Mortality from Linked Records* Series 20 Number 12
U.S. NATIONAL CENTER FOR HEALTH STATISTICS (1976) *Monthly Vital Statistics Report Advance Report Final Natality Statistics 1975 25/10* Suppl.
WALTHER, H. (1973) 'Die Infektion mit Trichomonaden in ihrer Klinik, Therapie und Bedeutung für Fertilität und Sterilität' *Z. Hautkr. 48* 553-562
WEEKS, A.R.L., MENZIES, D.N. & DEBOER, C.H. (1977) 'The relative efficiency of bed rest, cervical suture and no treatment in the management of twin pregnancy' *Brit. J. Obstet. Gynaec. 84* 161-164
WEIDINGER, H. & WIEST, W. (1973) 'Die Auswirkungen langdauernder Wehenhemmung mit Th 1165a und Isoptin auf Herz. Kreislauf-, Organ- und Stoffwechselparameter der Mutter' *Z. Geburtsh. Perinat. 177* 238-244 see also 223-232, 233-237, 244-251
WEIDINGER, H. & WIEST, W. (1974) 'A comparative study of the epidemiological data of pregnancies with and without tendencies to premature delivery' *J. Perinat. Med. 2* 276-287
WESSELIUS-DE CASPARIS, A., THIERY, M., YOLESIAN, A., BAUMGARTEN, K., BROSENS, I., GAMISANS, O., STOLK, J.G. & VIVIER, W. (1971) 'Results of double-blind multicentre study, with ritodrine in premature labour' *Brit. Med. J. 3* 144-145
WIDMAIER, G. & REICHARDT, H.D. (1973) 'Erfahrungen mit einer erweiterten Indikationsstellung zur Zervix-Cerclage in der Schwangerschaft' *Zbl. Gynäk. 95* 16-21
WREN, B.G. (1970) 'Subclinical renal infection and prematurity' *Obstet. & Gynec. Survey 25* 1045-1047
WRIGHT, C.S.W., CAMPBELL, S. & BEAZLEY, J. (1972) 'Second-trimester abortion after vaginal termination of pregnancy' *Lancet 2* 1278-1279
WYNN, M. & WYNN, A. (1974) The Protection of Maternity and Infancy: *A Study of the Services for Pregnant Women and Young Children in Finland* Council for Children's Welfare
WYNN, M. & WYNN, A. (1975) *Nutrition Counselling in the Prevention of Low Birth-Weight; some conclusions about antenatal care following a visit to Canada* Foundation for Education and Research in Childbearing
WYNN, M. & WYNN, A. (1976) *Prevention of Handicap of Perinatal Origin; an introduction to French policy and legislation* Foundation for Education and Research in Childbearing
WYNN, M. & WYNN, A. (1977) *Administration and financing of a health service: a note on Swedish elected county health authorities and the Swedish county health tax* Evidence to the Royal Commission on the National Health Service
ZAHN, V. (1973) 'Tokolyse mit einem Th 1165 alpha-Dosier Aerosol' *Geburtsh. u. Frauenheilk 33* 818-821
ZAHN, V. & JOHANNIGMANN, J. (1975) 'Partusisten in der Geburtshilfe' *Zbl. Gynäk. 97* 605-611
ZAKHARCHUK, S.S., GOGOL, M.E. & MUDRA, N.P. (1972) 'Significance of urogenital trichomoniasis in the etiology of abortive pregnancy' *Akusch. i Gynek. 9* 44
ZWAHR, C. (1975) 'Ein Beitrag zum Problem der latenten Morbidität nach Interruptio bei Erstschwangeren - das Ergebnis hysterosalpingographischer Nachuntersuchungen' *Zbl. Gynäk. 97* 78-84
ZWAHR, C., KNORRE, P. & KUNZ, L. (1974) 'Zur Frage der Rehabilitation nach Interruptio seit Legalisierung der Schwanger-schaftsunterbrechung' *Zbl. Gynäk. 96* 2-9

By Margaret Wynn and Arthur Wynn

60p

NUTRITION COUNSELLING IN THE PREVENTION OF LOW BIRTHWEIGHT. SOME CONCLUSIONS ABOUT ANTENATAL CARE FOLLOWING A VISIT TO CANADA

by Margaret Wynn and Arthur Wynn

40p

PREVENTION OF HANDICAP OF PERINATAL ORIGIN. AN INTRODUCTION TO FRENCH POLICY AND LEGISLATION

By Margaret Wynn and Arthur Wynn

Price £2.00

From Foundation for Education and Research in Child Bearing, 27 Walpole Street, London SW3. Telephone 01-235 1343

THE DEVELOPING EMBRYO

Slide Set No 1. The Development of the Foetus

Slide Set No 2. Care During Pregnancy

Teacher's Notes and Work Cards included

These two slide sets have been produced in collaboration with the Foundation for Education and Research in Child Bearing.

Of central interest to teachers in biology and health education. Price £4.32 plus VAT 48p. Postage 16p.

From: Education Productions Limited,
Bradford Road,
East Ardsley, Wakefield,
West Yorkshire WF3 2JN.

Printed by DAVEY-BOLTON LIMITED, THE OLD POWDER WORKS, POWDER WORKS LANE, MELLING, MERSEYSIDE